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WORKING PLAN

FOR THE

GODAVARI LOWER DIVISION

1934 TO 1944

BY

R. B. CORNWELL, I.F.S.
Deputy Conservator of Forests

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WORKING PLAN FOR THE GODAVARI LOWER DIVISION.

PART I.

Summary of Facts on which the proposals are based.

CHAPTER I.—THE TRACT DEALT WITH.

SECTION 1.—NAME AND SITUATION.

1. *General.*—This working plan is for the reserved forests of the Lower Godavari division, excluding the Rampa Agency, where forest reservation is not yet complete, and forest organization has not advanced far enough for the reserves to be brought under a regular working plan. Besides, the Rampa will probably be separated from the Lower Godavari division before this working plan comes into force.

2. *Geographical position and boundaries.*—With the exception of the Upputeru reserve of the West Godavari district, all the forests to be worked under this plan are situated in the East Godavari district, east of the ghauts, and below the river gorge. They lie between latitudes 16° 24′ and 17° 37′ North, and longitudes 81° 10′ and 82° 52′ East. The area included in this plan is bounded on the north by the Nizam's dominions and the Rampa Agency; on the south by the Bay of Bengal; on the east by the Vizagapatam district and the Bay of Bengal; and on the west by the Nizam's dominions and the West Godavari district.

SECTION 2.—CONFIGURATION OF THE GROUND.

3. *General.*—About two-thirds of the forest area of the Lower Godavari division is hilly, and the rest is more or less flat. The hills lie in two main groups: one west of the Godavari, in the Polavaram taluk; and the other east of the Godavari, in the north-east corner of the district.

4. *The Western group of hills.*—The first group is formed by a part of the Eastern Ghauts and its buttresses. It includes Papikonda, Kovvada blocks I and II, and Kopalli reserves. The most prominent feature in this group is the flat-topped crest of Papikonda reserve rising to a height of 2,482 feet above mean sea level. The Papikonda bluff which dominates the entrance to the Godavari gorge is situated outside the reserved forest. The mean elevation of the hills in this group is about 1,500 feet.

5. *Drainage of Papikonda reserve.*—The prevailing slope in Papikonda reserve is from west to east; and the country is drained by the Osur Kalava and the Patta Vagu. These streams combine lower down to form the Papikonda Vagu which flows eastwards into the Godavari.

6. *Drainage of remaining reserves.*—Over the rest of this group of hills the prevailing slope is southwards; and the country is drained by the Balneru Vagu, the Pedda Kalava and the Pedda Vagu. All three streams flow to the south. The Balneru Vagu drains the western slopes of Papikonda and Kopalli reserves, crosses the Local Fund road near Janagareddigudem, and flows into the Yerra Kalava. The Pedda Kalava drains the central block of hills, flows in a sinuous course past the villages of Chintapalli, Munjalur and Kopalli, and turns eastwards at the southern extremity of Kovvada block II. Thereafter, as the Kovvada Vagu, it crosses and recrosses the Polavaram road and eventually goes to feed a series of small tanks. The Pedda Vagu drains the eastern slopes of the Kovvada blocks, and shortly after leaving the forest it breaks up in a network of irrigation channels.

7. *The Eastern group of hills.*—The group of hills in the north-east corner of the district covers a much larger area than the Papikonda group. It includes twenty-five reserved forests, which are contiguous, or in close proximity one to the other. The hills in this group are outliers of the Eastern Ghauts and flank the main range, the ridges running north-east to south-west, more or less parallel to the ghauts and the coast. The highest

point is Gundalamma Konda in Lododdi reserve, 2,668 feet above mean sea level. The elevation declines from north to south, the mean elevation of the ridges being about 1,000 feet.

8. *Drainage of the eastern groups of hills.*—The prevailing slope is south-west to south, and the three main streams that drain the area flow in this direction. The Madi Eru, rising in the Vizagapatam district, flows past Jeddangi, breaks through the gap between Doramamidi and Veerabhadrapuram reserves, and discharges into the Eleru. The Donigedda, rising in the Aminabada and Vatangi reserves, crosses the Agency road just below Jeddangi, and flowing south, more or less parallel to the road, empties itself into the large Lingamparti tank. The Gokavaram Vagu drains the Lododdi and Vatangi reserves, runs between Lingamparti and Vuligogula reserves, and ultimately feeds a series of small irrigation tanks.

9. *The up-land plains.*—The Beddadanole reserve in the north-east corner of the division, the Marlagudem reserve about 2½ miles north of Jangareddigudem, and the two Devancheruvu blocks near Rajahmundry, are the only up-country reserves situated on flat or gently sloping ground; but nearly all the hill reserves contain irregular belts or patches of flat ground, chiefly alongside the boundary lines and at the mouths of re-entrant valleys.

10. *Drainage of the up-land plains.*—The Beddadanole reserve is drained by the Sangam Vagu which flows southwards across the reserve into the Yerra Kalava. The Marlagudem reserve is drained by feeders of the Balneru Vagu.

11. *The Coringa forests.*—The mangrove forests of Coringa are situated on flat swampy featureless ground amongst a network of salt water creeks. The only relieving feature is a narrow belt of sand, with low dunes, along the eastern boundary of the reserve. This runs out into a sandspit at the south-east corner of Hope Island; and the sandspit thrusts northwards into the Cocanada Bay for about ten miles, terminating in a headland known as Godavari Point. The Coringa backwater, south of a line joining Godavari Point with Cholangi Point, is reserved forest forming part of Coringa Extension reserve.

12. *The Kandikuppa forests.*—The configuration of Kandikuppa reserve is similar to that of the drier parts of Coringa.

13. *The Upputeru forests.*—The Upputeru reserve is about 4 miles from the coast and a considerable area is beyond the influence of ordinary tides. A noticeable feature of this reserve are the low sandy ridges which run from west to east, and stand from ten to twenty feet above the swamps. They are known locally as *tippas*; and nearly all the villages in this locality are built on these *tippas*.

SECTION 3.—GEOLOGY, ROCK AND SOIL.

14. *Literature.*— The geology of the Godavari district appears to have attracted attention as far back as 1814 when "Tracts, Historical and Statistical, on India" by Dr. Benjamin Heyne was published. The tracts contain many references to the geology of this district. In 1830, H. H. Voysey, Surgeon and Geologist to the Great Trignometrical Survey, visited parts of the Godavari district and his reports were published in the Journal of the Bengal Society, Volume II (1833). In 1835, Dr. P. M. Benza, Medical Officer to the Governor of Madras, when on tour in the Northern Circars, noticed the occurrence of traps with fossiliferous beds in the neighbourhood of Rajahmundry, and his observations were published in the Madras Journal of Literature and Science, Volume V (1837). In 1850, Mr. Walter Elliott, M.C.S., while stationed at Rajahmundry, worked at the inter-trappean beds at Kateru, and his notes on the fossils of this area were published in the Journal of the Asiatic Society, Bengal, Volume XXII (1854). A year or two later the Rev. S. Hislop noticed the same inter-trappean beds, and wrote two papers on this subject which were published in the Journal of the Geological Society, London, Volume XI (1855), and Volume XVI (1860). In 1870–71, Mr. W. T. Blanford of the Geological Survey of India, traversed part of the Godavari district, and his notes were published in the Records of the Geological Survey of India, Volume IV (1871) and Volume V (1872). He was followed by Mr. William King, Deputy Superintendent, Geological Survey of India—later Dr. William King, F.G.S.—who made the first and only systematic survey of the geology of this district. Notes on his early work were published in the Records of the Geological Survey of India, Volume VII (1874) and Volume X (1878); and later he wrote two memoirs: "The Upper Gondwanas and other formations of the coastal region of the Godavari district" published in 1880, and "Geology of the Pranhita—Godavari valley" published in 1882. These two memoirs contain all that is known of the geology of the East Godavari district. Unfortunately, the mass of crystalline rocks, on which the greater part of the forests of the Lower Godavari division stands, has been examined somewba cursoril and the information available is meagre.

15. *Classification of rocks.*—The rocks of the forest areas of the Lower Godavari division may be classified into four main groups :—

Forest areas.	Local group.	Classification.	
		Geological survey of India.	European.
(1)	(2)	(3)	(4)
1 All the hill forest reserves of the division and part of Beddadanole reserve.	Gneiss	Gneisses of the Eastern region of the Peninsula.	Azoic, Crystalline, or Metamorphic Series.
2 Marlagudem reserve and part of Beddadanole reserve.	Kamthi and Barakar sandstones.	Lower Gondwanas ..	Upper Palaeozoic.
3 The Devancheruvu blocks ..	Rajahmundry sandstone.	Cuddalore sandstone.	Middle Eocene.
4 The Mangrove reserves, and a few lankas on the skirts of the hill reserves.	Alluvium	Recent	Recent.

16. *Rocks of the hill reserves.*—In the hill reserves, the underlying rock is gneiss, generally well-bedded, massive and granitoid. Seams of schistose gneiss are common : they contain a high percentage of quartz and can be located by a surface layer of small quartzite stones. Elsewhere, notably in the Polavaram group of hills, the gneiss is frequently felspathic. It weathers into a rock, not unlike grey sandstone, which is soft and friable. On the ridges the outcrops of rock are undergoing active laterization. This is most noticeable on the Papikonda terrace where there are large loose slabs of laterite. The high-level laterite crumbles and is washed down the hillsides and reappears on the flat ground as a surface layer of red gravel.

17. *The rocks of Marlagudem and Beddadanole reserves.*—The underlying rock in Marlagudem and the greater part of Beddadanole is sandstone. In parts of Beddadanole reserve the sandstone is of the Barakar series which is generally associated with coal. It is a soft coarse felspathic sandstone which wears into characteristic pot-holes along water courses, and the colour is grey or buff. In parts of the northern half of Beddadanole reserve the underlying rock is gneiss.

18. *Coal borings in Beddadanole reserve.*—In 1872, Dr. William King discovered the Singareni coal-field, and he traced the Barakar series into what is now the Beddadanole reserve. In 1874 and 1875 there was considerable activity in this area : several bore-holes were sunk, and for a while hopes ran high. In 1876, after six bore-holes had been sunk to depths ranging from 193 to 356 feet, the boring was abandoned as the only mineral obtained was a soft coaly shale of no use as fuel.

19. *The rocks of the Devancheruvu reserve.*—The underlying rocks in the two Devancheruvu blocks is a hard heavy purple or red ferruginous sandstone, which disintegrates into a coarse dry sandy soil. It is known as Rajahmundry sandstone, and runs in a low long ridge from Rajahmundry to the outskirts of Peddapuram where the red hills form a prominent feature of the landscape.

20. *Broken ground.*—On the flat ground that skirts the slopes of the hill reserves, and in the upland plains forests, there are extensive belts of a loose friable clayey soil, which is cut up badly by water action, and which, for want of a more suitable name, is commonly referred to as "broken ground." In general physical properties, it is rather like black cotton soil except that it is ash grey or buff, and of lighter texture. On the patches of broken ground the tree growth fades away, or persists as a very open stunted crop with *Dodonea viscosa* and *Webera corymbosa* as the type species.

21. *Soils.*—The soils commonly found in the forests of the Lower Godavari division and their approximate distribution are as follows :—

Kind of soil.	Approximate distribution.
(1)	(2)
1 Sand	The Kandikuppa Casuarina plantation, the Coringa sandspit, and the *tippas* of Upputeru reserve.
2 Light sandy soil	Marlagudem reserve, and parts of Beddadanole and Devancheruvu reserves.
3 Dry shallow stony soil ..	All the open hillsides in the division, part of the flat ground that skirts the hills, and part of the Devancheruvu reserves.
4 Red lateritic soil	Common on the flats and gently sloping ground of Peddapur and Gokavaram ranges, notably in Tirumalayapalem, Mallavaram and Sudikonda reserves.
5 Light loam	The well drained Teak lankas of Polavaram range and the river terraces in parts of Peddapur and Gokavaram ranges.

Kind of soil. (1)	Approximate distribution. (2)
6 Heavy loam	The low-lying parts of the Ravigudem valley; part of the western half of Papikonda reserve; and in low-lying valleys and old tank beds throughout the division.
7 Heavy alluvium	The mangrove forests.
8 Black cotton soil	The northern extremity of Beddadanole reserve, and parts of Aminabada, Vatangi and other reserves of Peddapur range.
9 Broken ground	In irregular belts throughout the division.

22. *Formation of the mangrove swamps.*—At Dowlaishweram, the Godavari branches into two main streams: the eastern or Gautami Godavari, and the western or Vasishta Godavari. The mangrove forests at Coringa and Kandikuppa are the gift of the Gautami Godavari. The heavy sand-drift moving up and down the coast tends to form bars across the mouths of the Godavari; and the silt carried down the river meets the opposing sand-drift and tidal currents and is deposited at the mouths; thus extensive mud flats are formed, on which the mangroves soon establish themselves.

23. *Growth of the mangrove swamps.*—The present town of Coringa was built in 1759 by Mr. Westcot, an English merchant, but there are no records available to show how the mangrove forests stood in relation to the town at that date. The earliest record available at Cocanada is a survey of the Coringa Bay made in 1857 by Lieutenants Taylor and May of the Indian Navy, on which the anchorages of 1806, 1816 and 1866 are marked. This, with the marine surveys of 1891, 1901, 1911 and 1924, and the working plan survey of 1933, enables one to trace the growth of the mangrove swamps during the past seventy-five years with fair accuracy. During this period, the numerous shallow bays on the northern shore have silted up forming a more regular shore line, and the mangrove swamps have advanced about a thousand yards northwards into Coringa Bay. However, it is to the south of Hope Island, and in the neighbourhood of Nagadaruva, in Coringa west block, that the greatest changes have taken place. In 1857, almost the entire area now occupied by compartments 4 and 5 was under water. The channel south of Hope Island light-house was four-hundred yards wide in 1857, and the light-house stood on the bank. The channel is now only forty yards wide, and the light-house is about 250 yards away from the bank. During the past fifty years considerable accretions have formed to the south of Hope Island. They now form part of Coringa Extension reserve.

24. *Advance of Godavari Point, and silting up of Coringa Bay.*—In 1857, there was no sandspit, and Godavari Point was at the south-east corner of Hope Island. By 1901, the sandspit had formed and Godavari Point had moved 8 miles to the north. During the next ten years the sandspit turned north-west, and Godavari Point moved forward 143 chains. Between 1911 and 1924 it advanced about a quarter of a mile in the same direction; and the working plan survey made in February 1933 showed a further advance of 660 yards. Meanwhile the Coringa Bay has continued to silt up rapidly, and at the present time the mean depth of the water is less than 5 feet over an area exceeding twenty square miles.

25. *Changes in the Gautami Godavari.*—The Dowlaishweram anicut was completed in 1852, and a considerable quantity of water was diverted into irrigation channels. This reduced the volume and velocity of the Gautami Godavari; and it is believed to have been the cause of the extensive accretions that were formed between 1857 and 1911. This agrees with the theory, that slow flowing streams form alluvial deposits at their mouths more readily than fast-flowing rivers which are able to break past the sand bars and carry the silt out to sea. About twenty years ago, the main stream of the Gautami Godavari changed its course at the Nilapalli bend: instead of flowing out to sea along the Gaderu, past Hope Island, it turned west and then south entering the sea off Sacramento Point. This greatly reduced the activity of the Gaderu. A bar is forming at its junction with the main stream, and no great changes have taken place at its mouth during the past fifteen years. On the other hand extensive accretions are being formed off Sacramento Point.

SECTION 4.—CLIMATE.

26. *Seasons.*—There are three seasons in the year: the cold weather, the hot weather, and the rains. The cold weather commences at the beginning of December and lasts until the end of February. During this period the mean total rainfall is under an inch; the maximum temperature averages about 80 degrees; and the minimum frequently falls below 60 degrees. The days are cool, bright and dry. The hot weather commences at the beginning of March and continues until the rains break, about the middle of June. In the latter half of April and the beginning of May there are local showers, usually in the

afternoons, which lay the dust and bring out the blossom and the new leaf. Thereafter, as the westerly elements in the wind prevail, the temperature rises steadily; and the maximum temperatures are recorded when the wind blows from due west, generally at the end of May or early in June. The rains commence in the middle of June and continue until the end of November. Whenever it rains and blows the days are cool and pleasant; but there are several breaks, both during and between the monsoons, when the wind drops, the sun shines fiercely, and the days and nights are warm and muggy.

27. *Temperature.*—The maximum temperature recorded at Cocanada is 118 degrees, and the minimum is 56 degrees. As parts of the division are both hotter and colder than Cocanada, the extreme range is probably not less than 70 degrees. The hottest days of the year are at the end of May or early in June, and the coldest days are early in January; but the extremes of temperature last for only a few days. The mean temperatures during the year are as follows:—

Season. (1)	Mean maximum temperature. (2)	Mean minimum temperature. (3)	Mean daily range of temperature. (4)
Cold weather	80°	65°	15°
Hot weather	97°	79°	18°
Rains	88°	76°	12°
Whole year	89°	75°	14°

28. *Winds.*—In January and February there are light cool north-easterly winds, and the air is dry. In March the wind veers to the south and south-west, and blows during the day, but generally dies down at sunset, and the nights are still and close. In May, westerly elements prevail, and there are local squalls which usually blow in the afternoon, frequently with short heavy showers of rain and sometimes with hail. Towards the end of May hot dry winds blow from the west, and the temperature rises rapidly. In June the south-west monsoon sets in, and, until the end of September, the general direction of the wind is from the south-west. At intervals during the rains, the wind dies down and it is calm and sultry. In October the wind veers to the north, and shortly afterwards the north-east monsoon sets in with strong gales and a few heavy showers of rain. Cyclones are apt to occur in the Bay of Bengal at this time of the year, but they seldom cross the coast of the East Godavari district. In 1923, considerable damage was done in and around Cocanada by a cloud burst; but the last cyclone that did extensive damage in the division was in 1904.

29. *Rainfall.*—The mean annual rainfall for the past fifty-one years is 42·71 inches. The following statement shows the mean monthly distribution for this period:—

Month. (1)	Inches. (2)	Remarks. (3)
January	0·23	Cold weather, 3 months, 0·98 inch.
February	0·33	....
March	0·42	Hot weather, 3½ months, 3·41 inches.
April	0·92	....
May	2·07	....
June	5·77	South-west monsoon, 3½ months, 27·69 inches.
July	7·41	....
August	7·17	....
September	7·34	....
October	7·31	North-east monsoon, 2 months, 10·53 inches.
November	3·32	....
December	0·42	....

These figures show that the district gets about two-thirds of its annual rainfall in the south-west monsoon. During this period the Agency gets more rain than the coast; whereas the coast gets more rain than the Agency in the north-east monsoon. The highest rainfall recorded in a year was in 1893 when Chodavaram in the Rampa Agency recorded 86.02 inches, and the adjoining areas in the Lower Godavari division probably received as much as Chodavaram. The lowest annual rainfall is 13.4 inches recorded at Tuni in 1876. On the 16th November 1923, 10.6 inches of rain was recorded at Cocanada. This probably is the highest fall recorded in a period of twenty-four hours. A statement showing the monthly rainfall recorded at six revenue stations and six forest stations in the Lower Godavari division during the past ten years is given in Appendix III (a) and (b).

30. *Tides.*—The zero or datum line used in the preparation of local tide tables is the Indian spring low-water level. The Karachi mean sea-level, ordinarily referred to as MSL., is 2.35 feet above the Indian spring low-water level; and the mean sea-level on the

Cocanada coast is 2·84 feet above the datum line. The extreme range of the tides in the Coringa reserves is about 8 feet, ranging from + 7 feet to — 1 foot; and the mean daily range is about 3 feet 6 inches. The highest tides of the year occur in November and December, and the lowest tides in March and April.

31. *Health.*—Malaria is prevalent throughout the forest reserves of the Agency and the uplands. The mangrove forests and the two Devancheruvu blocks are more or less free of malaria. Thougn all the reserved forests in the Agency are malarial, the intensity varies greatly. Certain areas such as Beddadanole, Marlagudem and Rajavommangi are more or less safe; whereas Vatangi, Lododdi, the Ravigudem valley and the head of the Puliramudugudem valley are notoriously unhealthy. The most common form of malaria is the subtertian fever induced by the parasite *Plasmodium falciparum*. Although it is the most malignant form of malaria it does not appear to be very persistent. It was noticed that rangers and foresters on the working plans staff, who were attacked with malaria in the Ravigudem valley, recovered rapidly when they received regular treatment at Cocanada, and there was no recurrence of malaria. There have been a few cases of blackwater fever in the Polavaram range. This fever is believed to be caused by the association of an unknown virus with *Plasmodium falciparum*, the malignant tertian parasite. The cause is not yet definitely known, nor is there any specific cure; but *Cassia beareana* taken promptly has shown good results; and in the Agency this drug is considered to be a definite specific for blackwater fever. Dysentery and diarrhœa are common during the early rains. On the whole the Agency tracts are definitely unhealthy; and the vitality and efficiency of the protective staff are greatly impaired by malarial malaise.

SECTION 5.—WATER-SUPPLY.

32. *General.*—During the rains and in the cold weather, water is available in all the reserves. In the hot weather nearly all the reserves are dry. There are two perennial streams in the Ravigudem valley: the Patta vagu and the Gampa vagu, and water is plentiful in Vatangi reserve throughout the year. Elsewhere, the streams either dry up, or hold only a few small pools of stagnant water. In the mangrove forests, fresh water is available in the creeks from the commencement of the rains until the end of October in Coringa reserve, and the end of January in Upputeru reserve. Thereafter, no fresh water is available in the mangrove forests, and water for cattle is carried to the forest in boats and stored at certain watering places. In the hot weather fresh water, fit for drinking, may be obtained by digging pits in parts of the Coringa sandspit, and throughout the Kandikuppa Casuarina plantation; while in Upputeru reserve it is obtained from rain-fed ponds, and when these dry up, from temporary wells in parts of the *tippas*. The supply of drinking water at the forest bungalows, sheds and camping grounds is good and sufficient except at Coringa, Bothappagudem, Ankhanagudem and Chintapalli. At Coringa, shallow wells have to be dug in the sand daily; and in the hot weather the water is brackish. At Bothappagudem the only water obtainable in the hot weather is from small pools in the stream bed; and the water contains a high percentage of organic impurities. At Ankhanagudem, a village tank provides the water supply; and, as cattle wallow in the tank and it is used for washing clothes and other insanitary purposes, the water is filthy. At Chintapalli, the water is excessively hard, and scarce in the hot weather. In the Agency all well-water is hard and induces constipation, and is thus a predisposing agent for malaria. In addition to the usual carbonates, it contains chlorides of calcium, sodium and magnesium.

SECTION 6.—DISTRIBUTION AND AREA.

33. *Distribution.*—The reserved forests of the Lower Godavari division are distributed in three main groups: the Polavaram group, the Yelleswaram group, and the Coastal group. In addition to these main groups, there are two small reserved forests, namely, Devancheruvu Blocks I and II situated astride the Rajahmundry-Peddapuram road within seven miles of Rajahmundry town. The Polavaram group is situated in the Polavaram taluk west of the Godavari river, and comprises six reserves: Papikonda, Kovvada Blocks I and II, Kopalli, Marlagudem, and Beddadanole. This group forms the Polavaram range with headquarters at Jangareddigudem. The Yelleswaram group commences about twenty miles north-east of Rajahmundry and continues in the same direction for about twenty-five miles. The Yelleswaram-Narasapatnam road runs lengthwise through the group dividing it into two approximately equal parts. The thirteen reserves to the east of the road and the Labberti, Singampalli, Anantagiri and Ultimathula reserves to the west of the road form the Peddapur range, with headquarters at Yelleswaram. The remaining eight reserves to the west of the road form the Gokavaram range with headquarters at Gokavaram. The coastal group comprises all the mangrove forests and Casuarina plantations in the division and includes: Coringa reserve and its extension, situated a few miles south of Cocanada; Kandipuppa reserve, about ten miles south of Coringa

Extension; and Upputeru reserve, about 50 miles south of Kandikuppa. This widely-strung-out group and the two Devancheruvu blocks form the Rajahmundry range with headquarters at Rajahmundry. About three-fifths of the area covered by the working plan is situated in the East Godavari Agency including the whole of Polavaram range, and the greater parts of Peddapur and Gokavaram ranges.

34. *Area.*—The aggregate area of the reserved forests under departmental control is 296,547·4 acres or approximately 463·36 square miles. The following statement shows the areas of the reserves and the grouping into ranges :—

Reserved forest.	Area in acres.		Range.	Area in acres.
	Settlement figures.	Computed from Survey of India maps.		
(1)	(2)	(3)	(4)	(5)
Beddadanole	15,000·0	14,717·0	Polavaram	59,601·8
Marlagudem	2,100·0	2,150·0		
Kopalli	14,864·0	14,863·7		
Kovvada block I	14,451·2	14,388·2		
Kovvada block II	2,592·0	2,592·0		
Papikonda	10,891·0	10,890·9		
Tirumalayapalam	5,150·0	4,980·6	Gokavaram	54,134·9
Sudikonda	6,880·0	4,824·0		
Mallavaram	7,600·0	7,614·0		
Molleru	8,250·0	8,711·3		
Lakkonda	13,104·0	12,165·0		
Veerabhadrapuram	10,300·0	8,960·0		
Doramamidi	6,400·0	6,880·0		
Doramamidi Extension	36·0	..		
Labberti	6,500·0	6,828·8	Peddapur	1,02,527·4
Singampalli	3,142·0	3,520·0		
Anantagiri	3,050·0	1,836·8		
Ultimathula	2,600·0	2,688·0		
Banadapalli	5,800·0	5,703·0		
Rajavommangi	7,961·0	7,905·0		
Lododdi	7,200·0	7,349·0		
Aminabada	4,480·0	5,108·0		
Vatangi	8,840·0	8,634·0		
Sarlanka	15,000·0	11,782·0		
Raghavapatnam	3,600·0	2,560·0		
Jeddangi	5,775·0	5,568·0		
Peddagarangi	4,000·0	4,301·0		
Vuligogula	12,000·0	10,229·0		
Anantaram	4,000·0	3,590·0		
Annavaram	8,500·0	8,307·2		
Lingamparti	6,500·0	6,617·6		
Devancheruvu I	1,330·0	1,320·0	Rajahmundry	80,283·3
Devancheruvu II	768·9	768·9		
Coringa	7,800·0	10,483·2*		
Coringa Extension	48,121·6	48,176·2*		
Kandikuppa	8,035·0	8,708·6*		
Upputeru	10,875·0	10,826·4*		
			Total area of the division	2,96,547·4 acres or 463·36 square miles.

* *Note.*—The Coastal forests have not yet been surveyed by the Survey of India. The areas have been computed from the Working Plan Surveys of 1933 and are believed to be accurate.

35. *General inaccuracy of Settlement maps in Peddapur and Gokavaram ranges.*—In Peddapur and Gokavaram ranges there are wide differences between the Settlement areas and the areas computed from the one-inch Survey of India maps. This is due to the inaccuracy of the Settlement maps. The following are some of the numerous inaccuracies noticed during the preparation of the working plan :—

(*a*) If the common boundaries between Vatangi and Aminabada reserves are made to coincide, the meridians on the two Settlement maps make an angle of 18 degrees; and if the same is done to the Settlement maps of Vatangi and Lododdi reserves the meridians make an angle of 14 degrees.

(*b*) The area of Sudikonda reserve is 6,880 acres according to the Settlement map, whereas the 1931 two-inch Survey of India map shows the area to be 4,824·7 acres—a difference of over 2,000 acres.

(*c*) A line taken due east-west across the middle of Anantagiri reserve, was found to measure over 1,000 yards more on the Settlement map than on the one-inch Survey of India map.

(*d*) When the working plans survey of the plots in Banadapalli reserve to be included in the Conversion Working Circle was plotted on a copy of the Settlement map, one of the plots fell about a quarter of a mile outside the boundary of the reserve; but the survey fitted accurately on an enlargement of the one-inch Survey of India map of Bandapalli reserve.

The settlement areas have been computed from the inaccurate maps and are therefore equally inaccurate; consequently the areas computed from the Survey of India maps have been adopted in the working plan.

SECTION 7.—MAPS.

36. *Survey of India maps.*—Four-inch topographical maps are available for Papikonda, Kopalli and the two Kovvada reserves of Pollavaram range. The survey was made in the field season 1904–05, and the maps were published in 1907 in eight sheets: Nos. 308 N.W./3, 308 N.E./4, 308 S.E./2, 309 N.E./2, 322 N.W./3, 322 S.W./1, 322 S.W./3, and 322 N.W./1. Two-inch maps are available for the two Devancheruvu blocks of Rajahmundry range, sheet No. 65 G/16 S; and for Sudikonda, Tirumalayapalam and parts of Mallavaram and Lakkonda reserves of Gokavaram range, sheets Nos. 65 G/15 N, 65 G/15 S and 65 G/10 N. The field work was done in the season 1928–29, and the maps were published in 1931. One-inch topographical maps will be available for the whole division, excepting the Coastal forests, by the time this working plan is brought into force. The numbers of the sheets covering each range is shown below:—

(*a*) *Polavaram range.*—Sheets Nos. 65 G/3, 65 G/4, 65 G/7 and 65 G/8, surveyed in 1924–25 and published in 1926; and sheets Nos. 65 G/11 and 65 G/12, surveyed in 1928–29 and published in 1930.

(*b*) *The Devancheruvu blocks of Rajahmundry range.*—Sheet No. 65 G/16, surveyed in 1928–29 and published in 1930.

(*c*) *Gokavaram range.*—Sheets Nos. 65 G/15 and 65 G/16, surveyed in 1928–29 and published in 1930; and sheets Nos. 65 K/2 and 65 K/3, surveyed in 1931–32 and published in 1933.

(*d*) *Peddapur range.*—Sheets Nos. 65/K2 and 65 K/3, surveyed in 1931–32, and published in 1933; and sheets Nos. 65 K/6 and 65 K/7, surveyed in 1932–33 and to be published in 1934.

37. *Madras Survey maps.*—These maps are available for the whole of the Peddapur and Gokavaram ranges, the Devancheruvu blocks of Rajahmundry range, and the Beddadanole and Marlagudem reserves of Polavaram range. Most of these maps are on a four-inch scale, but some are on two-inch and eight-inch scales. The boundaries of the forest reserves as shown on these maps exhibit varying degrees of inaccuracy; and the topographical features have been roughly and inaccurately sketched. These maps have 'outlived' their purpose and are now of little use.

38. *Forest Department maps.*—The Coringa, Coringa Extension, Kandikuppa, and Upputeru reserves have been surveyed by the Working Plans division on a four-inch scale; and the maps are in five sheets, namely: Coringa West Block, Coringa East Block—two sheets, Kandikuppa reserve, and Upputeru reserve. These five sheets include the following eight felling series: Coringa, Hope Island, Bhyravapalem, Pandi, Pora, Losari, Dongapandi and Kottapasulamuri; also the Kandikuppa Casuarina plantation. In addition to these original surveys, four-inch maps have been prepared for all timber and fuel felling series in the Uplands and the Agency, and comprise eight sheets:—

(1) *Beddadanole Felling Series—Timber Clear-felling Working Circle.*—This map was enlarged from the Survey of India one-inch sheet. The entire boundary was traversed and checked; and the areas to be included in the working circle were surveyed by the staff of the Working Plans division.

(2) *Puliramudugudem Felling Series—Timber Clear-felling Working Circle.*—This map was traced from the Survey of India four-inch sheets (1907); and all the areas to be included in the working circle were surveyed by the staff of the Working Plans division.

(3) *Devancheruvu Felling Series—East and West—Upland Coppice Working Circle.*—This map was enlarged from the Survey of India two-inch sheet (1931) and minor alterations were made in the management details.

(4) *Sudikonda Felling Series—Upland Coppice Working Circle.*—This map was enlarged from the Survey of India two-inch sheet (1931) and the management details were posted from divisional control maps and re-arranged.

(5) *Tirumalayapalem Felling Series, North and South—Upland Coppice Working Circle.*—This was compiled in a manner similar to the Sudikonda felling series.

(6) *Mallavaram Felling Series—Upland Coppice Working Circle.*—This map was compiled in a manner similar to the Sudikonda and Tirumalayapalem felling series.

(7) *Northern Felling Series (Part)—Conversion Working Circle.*—This map shows only the areas that will be worked during the period of the plan. It was enlarged from the Survey of India one-inch map 65 K/6, not yet published; and the areas to be worked were surveyed departmentally. The entire felling series is distributed over a large area and could not be arranged conveniently on a four-inch map. The areas to be felled during the period of the plan in the Southern felling series of the same working circle, are incorporated in the four-inch maps of Sudikonda and Tirumalayapalem felling series.

(8) *Papikonda Experimental Working Circle.*—This map was compiled from the Survey of India four-inch maps of Papikonda reserve and Kovvada Block II, to show the management details of the Papikonda Experimental Working Circle on one sheet.

The Kandikuppa Casuarina plantation has been surveyed by the Working Plans division, and a map prepared on a scale of 8-inches = 1 mile. The Bamboo Working Circle map comprises three sheets—one each for the Polavaram, Peddapur and Gokavaram ranges—on a scale of 1 inch=1 mile. These maps have been compiled from the Survey of India one-inch maps in order to show the bamboo blocks in each range on one sheet; and, to facilitate inspection and control, details showing the distribution and density of bamboo have been posted on the map. A Management Map on a scale of 1-inch = 1 mile, has been prepared for the Rajahmundry range; and an Index Map on a scale of 1 inch = 4 miles shows the general lay-out of the division.

SECTION 8.—STATE OF THE BOUNDARIES.

39. *Natural boundaries.*—In the reserved forest of the Agency and the Uplands, the only true natural boundaries are a few streams which form short lengths of the boundary line. Wherever a ridge forms the boundary, it is defined by a cut line and cairns. In the Coastal forests the boundaries are mainly natural: the sea, the Gaderu, Coringa, Upputeru and Dongapandi rivers, and several minor creeks. These boundaries are liable to slow natural changes, but they require no maintenance.

40. *Artificial boundaries.*—The common form of exterior boundary is a cut line 12 to 30 feet wide, with stone cairns, about 4 feet high, constructed at the corners along the outer edge of the line. When the corner cairns are far apart intermediate cairns are constructed in sight of each other. A short wooden post is generally built into the head of the cairn, protruding about 15 inches, and bears the number of the cairn. The boundary between Beddadanole reserve and the Hyderabad State is 30 feet wide, with cut-stone boundary marks, 18 inches wide, 1 foot above ground, and 6 inches deep. The face of the stone on the British side of the line has a broad arrow cut into it, while the face on the Hyderabad side bears an equilateral triangle. In Coringa and Coringa Extension reserves, cut-stones 9 inches square in section and 3 feet long, are used as boundary marks; they project about 15 inches above the ground. In Upputeru reserve, stone slabs about 3 feet high, are used at the corner points of the boundary line; and low mounds of earth are constructed between these slabs. It is difficult to distinguish these mounds; they should be at least 4 feet high with as steep a slope as the soil will permit. The general condition of the exterior boundaries is more or less normal: good on flat ground and wherever it is easily accessible, and neglected elsewhere. The interior boundaries are roads, cart-tracks, streams and cut-lines. The cut-lines are generally from 6 feet to 8 feet wide, and the condition is similar to that of the exterior boundaries.

SECTION 9.—LEGAL POSITION.

41. *Dates of reservation.*—All the reserve forests have been settled and notified under section 16 of the Madras Forest Act—Act V of 1882; and the legal position is secure. Reservation was in progress from 1891 to 1900; and all the reserved forests except Coringa Extension were notified during this period. Coringa Extension reserve was notified under section 4 in 1901, but the section 16 notification was not published until 1921. The following statement shows the number and date of the section 16 notification of each reserve arranged chronologically by ranges:—

Range.	Reserved forest.	Number and date of notification under section 16 of the Madras Forest Act.	Remarks.
(1)	(2)	(3)	(4)
Polavaram ..	Beddadanole	No. 17, dated 17th December 1897.	
	Marlagudem	No. 304, dated 23rd June 1898.	
	Kovvada Block I ..	No. 161, dated 2nd April 1899.	
	Kovvada Block II ..		

Range. (1)	Reserved forest. (2)	Number and date of notification under section 16 of the Madras Forest Act. (3)	Remarks. (4)
Polavaram—*cont.*	Papikonda	No. 170, dated 11th April 1899.	
Gokavaram	Kopalli	No. 315, dated 4th July 1899.	
	Sudikonda	No. 53, dated 27th January 1892	22·5 acres in Sudikonda were disreserved under section 24 of the Madras Forest Act in G.O. Ms. No. 273, dated 24th February 1931.
	Molleru	No. 476, dated 6th October 1892.	
	Mallavaram	No. 160, dated 26th March 1895.	
	Doramamidi	No. 213, dated 24th April 1896.	
	Veerabhadrapuram	No. 215, dated 24th April 1896.	
	Lakkonda	No. 205, dated 25th April 1896.	
	Tirumalayapalem	No. 584, dated 9th December 1896.	
	Doramamidi Extension.	No. 407, dated 11th September 1899.	
Peddapur	Rajavommangi	No. 38, dated 24th January 1900.	
	Ultimathula	No. 386, dated 30th August 1900.	
	Raghavapatnam	No. 240, dated 2nd April 1891.	
	Sarlanka	No. 241, dated 2nd April 1891.	
	Anantaram	No. 242, dated 2nd April 1891.	
	Vuligogula	No. 215, dated 27th April 1891.	
	Banadapalli	No. 244, dated 27th April 1893.	
	Lododdi	No. 244, dated 27th April 1893.	
	Aminabada	No. 244, dated 27th April 1893.	
	Anantagiri	No. 244, dated 27th April 1893.	
	Labberti	No. 244, dated 27th April 1893.	
	Vatangi	No. 244, dated 27th April 1893.	
	Annavaram	No. 210, dated 24th April 1896.	
	Lingamparti	No. 211, dated 24th April 1896.	
	Peddagarangi	No. 214, dated 24th April 1896.	
	Jeddangi	No. 204, dated 25th April 1896.	
Rajahmundry	Singampalli	No. 455, dated 7th October 1897.	
	Devancheruvu blocks I and II.	No. 63, dated 10th February 1896.	
	Upputeru block II	No. 454, dated 16th November 1896.	
	Kandikuppa	No. 155, dated 28th March 1898.	
	Coringa	No. 122, dated 27th April 1898.	
	Coringa Extension	No. 36, dated 5th February 1921.	

42. *Enclosures.*—There are twenty-two enclosures in the reserved forests of the division. They are distributed as follows :—

(*a*) *Sarlanka reserve.*—Seven enclosures : Sarlanka, Dandisima, Ginnalaram, Pedduru, Avelthi, Kandregula and Mallikarjunaswamy temple.

(*b*) *Kandikuppa reserve.*—Four enclosures : Pandipalam, Pora, Gollamanda hut and Karavaka chakali huts.

(*c*) *Vuligogula reserve.*—Three enclosures : Kondappalli, Singaram and Vuligogula.

(*d*) *Papikonda reserve.*—Three enclosures : Ravigudem-Tiyyamamidi, Dharavada and Chilakalur.

(*e*) *Lakkonda reserve.*—Two enclosures : Vuyyalamudugu and Banzam.

(*f*) *Kovvada block I.*—Two enclosures : Veerampalem and Gummulur.

(*g*) *Kopalli reserve.*—One enclosure : Chamanapalli.

43. *Revision of inaccurate boundary descriptions.*—It was pointed out in paragraph 35, that many of the Settlement maps of Peddapur and Gokavaram ranges are inaccurate. The boundary descriptions are equally inaccurate ; and it is desirable to publish revised boundary descriptions for these reserves, and to mark the boundaries on the Settlement maps in accordance with the revised descriptions.

SECTION 10.—RIGHTS AND CONCESSIONS.

44. *Rights admitted at Settlement.*—No rights to pasture or forest produce were admitted at Settlement. The admitted rights include : rights of way ; rights to water ; rights to excavate wells in parts of Upputeru reserve ; rights to navigate the rivers and creeks of Coringa, Coringa Extension, Kandikuppa, and Upputeru reserves ; and the rights to fish in the rivers and creeks of Coringa Extension reserve. These rights bear lightly on forest management and administration and do no harm.

45. *Privileges and concessions.*—Certain privileges and concessions have been admitted, mainly of necessity. Some do little harm to the forest ; others are definitely injurious. Grazing is the principal privilege and does little harm except in the mangrove forests, where the water-buffalo lives largely on the four principal species. In the Agency, Koyas and Reddies are permitted to hunt without restriction. They have more or less exterminated sambhur and spotted deer by lying in wait at water-holes and salt-licks ; and the smoking out of Iguanas, and the annual hunting festival, are fruitful sources of forest fires. In the Coringa, reserve fishermen are permitted to remove small fuel on payment of a nominal fee. This results in indiscriminate hacking. In Upputeru reserve the trapping of fish is permitted throughout the reserve on payment of a small fee for each basket trap. This concession may perhaps be necessary, but it is definitely pernicious. A list of rights, privileges and concessions will be found in Appendix IV.

CHAPTER II.—THE FOREST.

SECTION 1.—COMPOSITION AND CONDITION OF THE CROP.

46. *General classification.*—The forests of the Lower Godavari division are of two main types :

(1) Mixed deciduous forests.
(2) Littoral forests.

The mixed deciduous forests occur in the Uplands and the Agency. The greate part of these forests is situated on hillsides with shallow stony soil ; and the growth is more or less of one type. The remaining forests are situated in shallow valleys, and on flat or gently sloping ground ; and the growth varies with the configuration, rock and soil.

The littoral forests are situated on heavy alluvial deposits at the eastern mouths of the Godavari and on the left bank of the Upputeru. They are composed of several littoral species, but are commonly referred to as Mangrove forests. The Casuarina plantations on the seaboard of Kandikuppa reserve are included in the littoral forests.

47. *The mixed deciduous forests.*—In the mixed deciduous forests the growth varies with the soil ; and it is convenient, for descriptive purposes, to classify these forests according to the soils on which they grow. According to Schimper's classification (1903) they are monsoon forests with edaphic sub-types ; and according to Warming and Vahl (1909) the species which occur in these forests are mesophytes with a few Psammophytes in the drier localities. However, as these ecological terms are not generally understood, and in themselves are not as clear as they might be, the mixed deciduous forests will be briefly described in common language in the following order :—

(1) forests of the hillsides.
(2) forests on the red lateritic soils.
(3) forests on the dry sandy soils.
(4) forests on the loams of the lankas and valleys.
(5) forests of the broken ground.
(6) forests on the heavy clay.

48. *Forests of the hillsides.*—The hillsides of the Peddapur and Gokavaram ranges support a mixed growth of bamboo, small timber, fuel, and soft woods, the proportions of which vary greatly in different localities. Bamboo—*Dendrocalamus strictus*—forms about thirty per cent of the crop. It occurs chiefly on the upper slopes where it is associated with *Anogeissus latifolia, Chloroxylon swietenia, Cochlospermum gossypium, Bombax malabaricum* and other allied species. On hillsides which contain no bamboo the same general type of tree growth prevails, with local variations in species and density. Bamboo finds a regular sale ; but the tree-growth is poor and of no market value, except where there is demand for small timber and fuel as on the lower slopes of Mallavaram, Sudikonda and Thirumalayapalem reserves. The hillside forests of the Polavaram range consist chiefly of bamboo—*Dendrocalamus strictus*—with an open overwood which varies greatly in composition, density and quality. Bamboo averages about fifty per cent of the crop, and *Anogeissus latifolia* is the chief species in the overwood. On quartzite and other dry soils the growth is poor and open, but wherever the soil is fairly deep, the density and quality of the overwood improves and bamboo fades away. Parts of the lower slopes and crests contain an open crop of teak and its usual associates, but the growth is stunted, badly-shaped and of little value. The general silvicultural condition of the hillside forests is unsatisfactory : the stocking is incomplete, regeneration is defective, and the bamboo forests have been over-felled in parts. However, it must be recognized that the poverty of the soil limits the scope for improvement ; and as there is no demand for fuel or small timber, and the forests cover immense areas, financial considerations restrict the treatment to mere protection. The bamboo forests are worked regularly but somewhat recklessly, and their general condition can be greatly improved. The hillside forests do not include the gentle slopes of Kovvada block II and the valley at the head of the Addakonda-Pothanakonda slopes : these will be described separately.

49. *Forests on the red lateritic soils.*—The red lateritic soils occur mainly on the flat or gently-sloping ground that skirts the hillsides of Peddapur and Gokavaram ranges. These soils support a great variety of species including : *Chloroxylon swietenia, Erythroxylon monogynum, Zizyphus xylopyrus, Albizzia amara, Cassia fistula, Bauhinia racemosa, Wrightia tinctoria* and other allied species. The forests are generally incompletely stocked, and the height growth is poor, averaging about 25 to 30 feet. Teak does not thrive on these soils and there is little bamboo. The forests are worked for fuel wherever there is a demand ; elsewhere they are merely protected, and are used as grazing grounds. The growth is improving and there is a fair amount of regeneration ; but with protection as the sole treatment, naturally the improvement is slow. As the soil on the Papikonda terrace of

Polavaram range is mainly red laterite, this area is included in the red lateritic soils. The terrace is an open grass land with a few scattered trees, chiefly *Xylia xylocarpa, Terminalia chebula, Pterocarpus marsupium* and *Dillenia pentagyna*. The growth is of no value.

50. *Forests on the dry sandy soils.*—These soils are confined to the Beddadanole and Marlagudem reserves of Polavaram range, and the Devancheruvu blocks of the Rajahmundry range, where the underlying rock is sandstone. The sandy soils occur mainly in the southern half of Beddadanole reserve; and the growth consists of a great variety of species including *Erythroxylon monogynum, Azadirachta indica, Zizyphus jujuba, Zizyphus xylopyrus, Caesalpinia coriaria, Bauhinia racemosa, Acacia leucophloea, Acacia ferruginea, Albizzia amara, Casearia tomentosa, Gmelina asiatica,* and *Emblica officinalis*. The height growth is more or less normal and regeneration is sparse. Climbers are plentiful, and in parts they combine with the low-branching trees and the undergrowth to form a dense tangle. The more common climbers are *Zizyphus oenoplia, Pterolobium indicum, Abrus precatorius,* and *Acacia caesia*. As there is no demand for small timber or fuel, these forests are not worked and are used chiefly as grazing grounds. The sandy areas of Marlagudem reserve are very similar to those of Beddadanole reserve, but the growth is a bit poorer. The Devancheruvu blocks are situated on red sandstone and the soil is generally dry and sandy. The growth consists of a low tangle of xerophytic evergreen species such as *Maba buxifolia, Memecylon edule* and *Mimusops hexandra,* associated with *Bridelia montana, Bauhinia racemosa, Diospyros sylvatica, Acacia sundra,* and other species that grow on dry soils. The common undershrubs are *Plectronia parviflora* and *Randia longisperma*; and the common climbers are *Acacia caesia* and *Abrus prectorius*. The general height of the forest is not more than about 20 feet, but there are patches where the soil improves, species such as *Albizzia amara* and *Acacia leucophloea* come in, and the height increases to about 30 feet. The forests are more or less fully stocked; and as they are within easy reach of Rajahmundry, they are intensively worked for fuel.

51. *Forests on the loams of the lankas and valleys.*—These forests contain the best growth in the Lower Godavari division; and, although they occupy a comparatively small area, they are of considerable economic importance. The growth varies with the locality; and, as the forests will be worked somewhat intensively, each of the following six sub-types will be briefly described:—

(1) The lankas of Peddapur and Gokavaram ranges.
(2) The valleys and minor lankas of Peddapur and Gokavaram ranges.
(3) The lankas and valleys of Papikonda reserve.
(4) The lankas and gentle slopes of Kovvada block II.
(5) The lankas of Kopalli and Kovvada block I.
(6) The lankas of Beddadanole reserve.

52. *The lankas of Peddapur and Gokavaram ranges.*—These lankas are situated on the banks of streams and on old river terraces. They occur in small irregular patches or strips. The soil is generally a deep loam on which there are some good patches of timber up to 70 feet in height and over 6 feet in girth, but both soil and growth vary within narrow limits. *Terminalia tomentosa* is the type species, and its common associates are *Largerstroemia parviflora, Albizzia lebbek, Adina cordifolia* and *Pterocarpus marsupium,* with *Xylia xylocarpa* on the fringes. There is no natural-grown teak in Peddapur and Gokavaram ranges, but the light loams of the lankas appear to be suitable for planting teak. The total area fit for planting teak is estimated at 1,169·5 acres.

53. *The valleys and minor lankas of Peddapur and Gokavaram ranges.*—In these localities the soil is a shallow sandy loam, which frequently overlies laterite beds. The depth and quality of the soil improve as the colour changes from reddish-brown to dark-brown, and the growth improves with the soil. There are patches of flat ground on which the soil and growth are noticeably better than that of the surrounding forests. Here the crop is generally an even-aged mixture of *Anogeissus latifolia, Terminalia tomentosa, Lagerstroemia parviflora* and other allied species, usually under 3 feet in girth and 35 feet in height, and probably of podu origin. As these are known locally as lankas, and as they differ greatly in soil and growth from the lankas which have already been described, they are referred to as minor lankas. Elsewhere the crop consists of a mixed fuel forest with a few patches of bamboo. The species are more or less the same as on the neighbouring red soils, but the height growth is better. The denser parts of the fuel forests of Sudikonda, Tirumalayapalem and Mallavaram reserves are included in this sub-type.

54. *The lankas and valleys of Papikonda reserve.*—The timber-bearing forests of Papikonda reserve are situated mainly on the lankas and gentle slopes of the Ravigudem, Chilekalur and Daravada valleys, and in the fan-shaped valley at the head of the Addakonda-Pothanakonda slopes. The elevation ranges from 1,200 to 1,400 feet above mean sea-level. The steep eastern slopes of the Tenkonda ridge and the Papikonda terrace, and the slopes of the hills, such as, Kappa Konda, that rise up from the Ravigudem valley,

contain an open crop of inferior species, either festooned with climbers, or mixed with grass and bamboo ; but there is no marketable timber on these slopes. The timber forests are of three broad types : the teak forests, the *Terminalia* forests, and the *Xylia* forests.

55. *The teak forests.*—The teak forests are found on the lankas of the Ravigudem valley, in the Addakonda-Pothanakonda valley, and on the gentle slopes along the southern boundary of the reserve south and south-east of Chilukalur. There is no teak in the Daravada valley ; and, except for the small Gummudu gandi lanka, there is no teak between the Patavagu and Chilukalur. Teak thrives best on the well-drained deep light loams of the lankas and on easy slopes where it attains a height of 75 feet and a girth of over 6 feet ; but at present there are few trees over 4 feet in girth. It avoids the heavy loams at the bottom of the valleys, and the size and quality decline rapidly on the dry stony slopes. The common associates of teak are *Pterocarpus marsupium, Terminalia tomentosa, Lagerstroemia parviflora,* and Rosewood. *Pterocarpus marsupium* appears to be an adaptable species, for it is found in all the three types of forest. Although rosewood is an associate of teak, the two species are by no means intimate : each grows at its best away from the other. Silviculturally the teak forests are in a most unsatisfactory condition, the result of numerous fires and years of neglect. The forests are more or less even-aged, and are mature or overmature ; they are incompletely stocked, even in the best areas ; and there are no pole crops, and no regeneration of teak and its more valuable associates. The teak is generally top-broken, fire-scarred or otherwise damaged ; and large woody climbers; such as *Butea superba* and *Bauhinia vahlii,* have done considerable injury to the forest and nothing has been done to eradicate them. Bamboo occurs throughout the teak forests, the density varying with the amount of overhead light. In the better-stocked areas, it declines to about five per cent of the crop, elsewhere it averages from 30 to 50 per cent.

56. *The Terminalia forests.*—The *Terminalia* forests are situated on the heavy loams at the bottom of the Ravigudem valley, chiefly south of the Pata Vagu and west of Ravigudem. The principal species is *Terminalia tomentosa* which attains a height of 100 feet and a girth of over 8 feet. The associate species are *Pterocarpus marsupium, Adina cordifolia, Xylia xylocarpa,* and *Albizzia procera,* with mango, *Syzygium jambolana,* and various evergreen shrubs along the water-courses. *Terminalia tomentosa* appears to be dying out : the present growth is mature or overmature, and there are no pole crops and no regeneration of this species. West of Ravigudem it is being displaced by *Xylia xylocarpa,* and elsewhere by miscellaneous inferior species. There is very little bamboo in the *Terminalia* belt.

57. *The Xylia forests.*—*Xylia xylocarpa* is at present the most active species in the Papikonda reserve : it has invaded the *Terminalia* forest, it descends the outer slopes and regenerates freely in the teak forests. A line taken from east to west across Papikonda reserve reveals all stages in the transition from a mixed deciduous forest of teak, *Terminalia tomentosa,* etc., to a *Xylia* forest associated with evergreen species. However, it is in the Daravada valley, from the enclosure to the Osur Kalava, that this species definitely predominates, and this area constitutes the *Xylia* belt. The presence of laterite beds on the Papikonda terrace, and the outcrops of laterite in parts of the *Xylia* forest, suggest that the predominance of *Xylia* may be due to a laterite subsoil. The forests are irregular and immature : there is very little *Xylia* over 4½ feet in girth. The associate species are *Pterocarpus marsupium, Terminalia tomentosa, Terminalia chebula,* and *Dillenia pentagyna* ; climbers are bad in parts, and regeneration is plentiful.

58. *The lankas and gentle slopes of Kovvada block II.*—The teak forests of Kovvada block II are situated in the north-east quarter of the reserve between the Totagandi Vagu and the Sengal Kalava, and they extend about five hundred yards along the gentle slopes to the south of the Sengal Kalava. The forests are of a drier type than the Papikonda teak lankas, consequently the teak does not attain the same dimensions and climbers are less plentiful ; but the quantity of teak per acre is greater than on the Papikonda lankas, and the forests are burnt more frequently. The best growth is on the Kotrupalli lanka, the quality declining with the steepness of the slopes. There is no teak on the steep slopes of the Sengal Kalava valley. The associate species arranged in proportionate order are *Anogeissus latifolia, Terminalia tomentosa,* Rosewood and *Pterocarpus marsupium.* The rosewood is of small dimensions and a high percentage is unsound. The silvicultural condition of these forests is unsatisfactory : fires do considerable damage, the stocking is incomplete, and there is very little regeneration of the principal species. Bamboo occurs throughout the teak forests. On the flat and gently sloping ground bordering on the Akulagandi Kalava, which forms part of the southern boundary of the reserve, there is an open crop of mature miscellaneous timber including *Terminalia tomentosa, Adina cordifolia* and *Anogeissus latifolia* standing over a fairly dense crop of bamboo. The steep slopes of Kovvada block II are of the hillside type.

59. *The lankas of Kopalli and Kovvada block I.*—These lankas occur in small strips or patches, along the edge of the boundary line, alongside parts of the Puliramudugudem-Munjulur cart-track, and up two or three small valleys. Most of the Kopalli lankas have

already been worked for fuel and small timber, and the growth consists of teak coppice, from primary growth to the pole stage, associated with a coppice crop of *Anogeissus latifolia, Lagerstroemia parviflora, Terminalia tomentosa, Cleistanthus collinus*, and other species. The unworked lankas and the gentle slopes contain some patches of good timber; but these low-level teak forests are much poorer than the forests on the higher levels of Papikonda reserve and Kovvada block II.

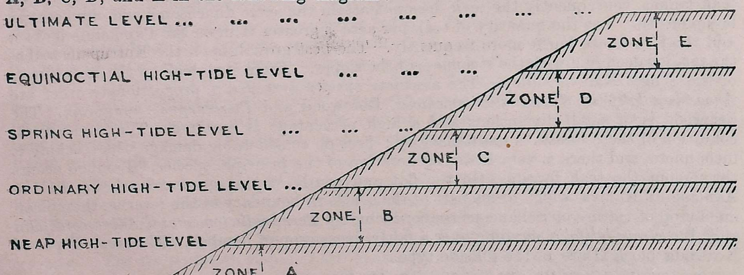
60. *The lankas of Beddadanole reserve.*—The teak lankas are situated in the northern half of the reserve, the best growth occurring in the north-east quarter. The growth on the lankas ranges from scattered malformed teak under 45 feet in height, forming about ten per cent of the crop, to well-grown teak, over 65 feet in height, forming about 40 per cent of the crop. Some of the lankas have been worked during the past ten years: the coupes are situated astride the Bothappagudem-Ankhanagudem road. Parts of the old coupes contain good stands of teak; but the coppice has never been tended, and the growing stock is now a disorderly tangle of teak coppice, miscellaneous inferior wood, and climbers. Parts of old coupes are unsuitable for growing teak. The growth on the workable lankas consists of a mature crop of teak with the usual associates. The teak, which forms on an average about 30 per cent of the crop, is chiefly of coppice origin, and is generally fire-scarred or otherwise damaged. The growing stock is in a most unsatisfactory condition: fires have done considerable damage; the better areas are festooned with large woody climbers, chiefly *Butea superba*; climbers are plentiful even in the second quality areas, where *Zizyphus oenoplia* attains unusually large dimensions; and there is no natural regeneration of teak. The present crop is of value chiefly because it contains sufficient timber to cover the costs of re-establishing these lanka forests, in parts of which the soil is a deep sandy loam well-suited for growing teak.

61. *Forests of the broken ground.*—On the large patches of broken ground which occur throughout the division, the forest is a low open scrub dotted with *Soymida febrifuga, Acacia sundra, Zizyphus xylopyra*, etc. The shrubs *Dodonea viscosa* and *Chomelia asiatica*, and the coarse Kopra grass are characteristic of these areas. The grazing is poor; and except for the fibrous Kopra grass—*Ischoemum angustifolium*—which is used for making ropes these areas are of little economic value.

62. *Forests on the heavy clay.*—These forests are situated in old tank beds and on patches of black cotton soil. In the old tank beds *Bambusa arundinacea* predominates associated with *Acacia arabica, Albizzia lebbek, Strychnos nux-vomica*, and other inferior species. At the northern extremity of Beddadanole reserve there is a fairly large patch of black cotton soil which contains an open crop of *Hardwickia binata*, chiefly old pollards associated with *Soymida febrifuga* and a fringe of degraded teak. These forests occupy comparatively small areas and are of little importance.

63. *The Mangrove forests.*—These tropical tidal forests differ widely from the monsoon forests of the uplands and the Agency, and it is necessary to have a correct appreciation of the differences. A brief survey of the habitat, and an examination of the ecological adaptations which enable the mangroves to grow and thrive in the difficult environment, provide the best line of approach to the silviculture of these forests.

64. *The habitat.*—The edaphic factors—those that relate to the soil—will be examined first. The formation of the deposits of alluvial silt has been described briefly in Chapter I. The deposits increase in height gradually: they are first exposed at low-tide but are submerged at all high-tides; later they rise above the neap high-tides and are exposed for a few days each month; still later they rise above the ordinary and spring high-tides, and the periods of exposure increase while the periods of inundation decline; and ultimately the ground rises above all tidal influence. There are thus five distinct zones of inundation: **A, B, C, D,** and **E** in the following diagram:—



The consistency of the silt is generally in direct relation to the extent of inundation, and varies from a fluid mud in zone A to a heavy stiff clay in zone E. There is no aeration in zones A and B, and very little in the remaining zones. Schimper first drew attention to the fact that plants growing in salt swamps absorb water with difficulty, and although the soils are completely or partially submerged in water, they are physiologically dry. Very little is known of the effect of common salt on the metabolism of plants, but it is believed to be detrimental to assimilation. The outstanding climatic factors of the habitat are a moderate rainfall averaging about 42 inches a year, tropical heat, bright light, and frequent high winds.

65. *Ecological adaptations in the pioneer species.*—The mangrove forests of the Lower Godavari division have not been studied with the care that these interesting forests merit, and very little precise information is available regarding the reactions of the individual species to the environment. Nevertheless there are certain well-marked adaptations, and these will be briefly described. The alluvial flats first appear at low-water, and are completely submerged at all high-tides. At this stage—zone A—there is no growth. The tidal level at which growth first establishes itself has not been investigated, but on theoretical reasoning it is believed to be approximately at the neap high-tide. Growth begins to appear when the silt deposits have reached a level at which they are exposed for several days on end. The pioneer species are Vilava-mada—*Avicennia alba*, and Tella-mada—*Avicennia marina*. The latter is the more active species and often forms pure crops on the primary accretions. Both species have numerous well-developed pneumatophores, shaped somewhat like asparagus, which enable them to withstand long periods of inundation; and their xerophilous foliage is an adaptation to the physiologically dry soil and the factors favouring rapid transpiration. Both pioneer species, and nearly all the trees that grow in inundation zones B and C, are viviparous or semi-viviparous. The fruits of the *Avicennias* are small heart-shaped leathery capsules. Germination starts before the fruits fall; and in October and November they may be seen floating in the creeks in all stages of germination. Warming—in his "Oecology of Plants" translated by Groom and Balfour, Oxford 1909—describes vivipary in the *Avicennias* as follows: " . . the endosperm and subsequently the embryo emerge from the seed and lie uncovered in the chamber of the ovary. The embryo is green and obtains food from the parent plant by means of a long, repeatedly branched hypha-like haustorial cell, which traverses the placenta." The radicles have hairy lateral roots—they are hooked in *Avicennia alba*—which enable the floating embryo to secure a firm hold in the soft mud; and once it is anchored it grows rapidly.

66. *Ecological adaptations in the flora of Zone B.*—Somewhere near the dividing line between inundation zones B and C, Nalla-mada—*Avicennia officinalis* comes in; and its dark obtuse leaves can be easily distinguished from the small pale-green acute leaves of Tella-mada, and the acuminate leaves of Vilava-mada. It has similar pneumatophores and a xerophilous foliage, but appears to prefer a firmer soil and less inundation than the two pioneer species. The following six species occur in zone C: Kalinga—*Sonneratia apetala*, Uppu-ponna—*Rhizophora mucronata* and *Rhizophora candelaria*, Urdu—*Bruguiera conjugata*, Kandilla—*Bruguiera cylindrica*, and Gedara—*Ceriops roxburghiana*. *Sonneratia apetala* has large woody conical pneumatophores and a markedly xerophilous foliage with the edges of the leaves frequently turned towards the light. The two *Rhizophoras* have stilt roots, the two *Bruguieras* have kneed pneumatophores, and *Ceriops roxburghiana* has rounded scaly reddish pneumatophores somewhat like those of the *Bruguieras*. These species are xerophilous in various degrees, and all are viviparous. The growth in this zone is more mixed than in the pioneer formations. Nalla-mada is the predominant species associated chiefly with Tella-mada. Kalinga was once very plentiful in Coringa reserve, but it has been wiped out by heavy lopping. The *Rhizophoras* are somewhat scarce and are confined to the banks of streams in parts of Coringa Extension and Kandikuppa reserves, and along the Upputeru and Dongapandi rivers of Upputeru reserve. Urudu is fairly plentiful in parts of Coringa Extension reserve and Gedara grows sporadically, chiefly in Coringa Extension and Kandikuppa reserves. The forests are evergreen, low-branched, and generally under 25 feet in height. They do not coppice.

67. *Ecological adaptations in the remaining species.*—As the ground rises above the spring high-tide level the true mangroves fade away, and Tilla—*Excoecaria agallocha*, and Thanduga—*Lumnitzera racemosa* take possession, either in pure crops, or more commonly associated with the woody shrub Guggilam—*Aegiceras corniculata*, and sometimes with each other. The growth occurs in strips of varying width alongside streams and creeks; and numerous large blanks are formed. Watson—in "Mangrove Forests of the Malay Peninsula" 1928—states that Tilla attains a height of 80 feet; and a girth of 6 feet or more; and that this species has pneumatophores in the form of lenticellate snake-like curvatures of the ordinary roots. In the Lower Godavari division the tree rarely exceeds 25 feet in height and 18 inches in girth, and apparently has no pneumatophores, but the

exposed roots and the stem exhibit chains of large lenticels. The foliage is xerophilous. Both Troup—"Silviculture of Indian" Trees—and Gamble—"Flora of the Presidency of Madras"—describe Tilla as an evergreen species. In the Lower Godavari division it is definitely leafless for a short period in the hot weather. Thanduga has buttress roots and well marked lenticels but no pneumatophores. The foliage is markedly xerophilous. The only other trees that grow in the mangrove swamps are Gangaravi—*Thespesia populnea* and Parivili—*Tamarix gallica*. They are found chiefly on the banks of the Dongapandi and Kothachedu in Upputeru reserve, in zone D and beyond tidal influence; but nothing definite is known of the extent of inundation and salinity that they can stand, nor of the adaptations that enable these species to thrive in the mangrove swamps.

68. *Undergrowth of the mangrove forests.*—There is very little undergrowth in the mangrove forests: not more than four species. The most common is Alchi—*Acanthus ilicifolius*, which is found growing in loose mud on the edges of streams and creeks, and in patches throughout the tidal area. It can be easily distinguished by its holly-like leaves, its large blue flowers, and its stilt roots. Alchi occurs in two forms: when growing in the open, the leaves are stiff and erect with wavy margins and well-developed prickles, and the internodes are armed with a pair of stipular spines; when growing under cover, the internodes are longer and unarmed, and the leaves are finer, the margins are less wavy, and the prickles are not so well-developed. Alchi has been declared to be beneficial to regeneration because it affords cover to Mada seedlings and saves them from being browsed down by buffaloes. On the other hand there is much evidence to show that Alchi retards regeneration by forming a screen which prevents the free drift of floating seed. On the whole it is probably more harmful than beneficial. The other species are Pisingi—*Clerodendron inerme*, Chillanki—*Dalbergia spinosa*, and Nalia-theega—*Derris uliginosa*. Pisingi grows in all the coastal forests, but is particularly plentiful in the Kandikuppa reserve. It can be distinguished by its white tubular flowers and its straggling branches which look very like lantana. Chillanki is a straggling shrub armed with stout spines which are said to be poisonous. Nalla-theega is the common climber of the mangrove swamps.

69. *The Blanks.*—The formation of blanks in the mangrove forests is generally attributed to the ground rising above tidal influence. At this stage the soil is unsuitable both for the mangroves and for the common species of the hinter-land, consequently large blanks are formed. Apart from these elevated blanks, there are depressions which remain under water for long periods, and the soil is excessively saline. These depressions are generally devoid of growth. The retention of all trees on the banks of creeks results in the formation of low bunds, by the roots and pneumetophores holding up the tidal silt. These bunds prevent the adjoining blanks being inundated by ordinary tides, and this probably leads to the formation of blanks. The blanks are formed not so much by the dying out of the forests as by failure to regenerate worked forests which have passed out of their normal inundation zones; and it must be recognized that this failure of regeneration is natural. Ordinarily, when the blanks are formed they expand fairly rapidly, but there are parts of Coringa reserve where Guggilam and Tilla are invading the blanks, and Thanduga is spreading in the blanks of Upputeru reserve. As long as the soil is saline, the weed Ilakura—*Suaeda maritima*—remains more or less in sole possession of the blanks; but as the salt is washed out of the soil by the action of rain water, Ilakura fades away and is replaced by the common grass Gariki-gaddi—*Cynodon dactylon*. The ground then becomes suitable for the cultivation of paddy.

70. *The evolutionary stages, and the transitory nature of the mangrove forests.*—The evolutionary stages in the development and decline of the mangrove forests have been shown to be directly connected with tidal inundation; and the rate at which the changes take place depends on the silting activity of the rivers and creeks. The normal stages are: naked mud flats; pure crops of Vilava-mada and Tella-mada; mixed-mada forests; Tilla-Thanduga forests with blanks; extensive blanks with *Suaeda maritima*; and finally grassy blanks fit for cultivating paddy. The forests are transitory in that the types of growth cannot be perpetuated *in situ*, and recruitment is obtained partly by accretion and partly within the forest. This will be discussed in greater detail in Chapter II of Part II.

71. *The stages of growth in the coastal reserves.*—The northern parts of the Coringa reserve, and the areas bordering on the Gaderu are well-wooded, and the Tella-mada type prevails. The quality of the crop declines southwards and westwards, passing first into the mixed-mada stage, and later into the Tilla stage with numerous large blanks. The large blanks—some over two hundred acres in extent—are found west of the Varava Kalava, and blanks occur in strips alongside most of the larger creeks. About 16 per cent of the total area of the reserve is blank. The greater part of Hope Island is still in the Tella-mada stage. There are fairly extensive blanks alongside the Bankol and Ingilayi nallas in the neighbourhood of the old light-house. The growth adjoining these blanks is

in the Tilla stage merging into a mixed-mada forest. The rest of the extension reserve is partly Tella-mada and partly mixed-mada forests with patches of Tilla and some small blanks. The greater part of Kandikuppa reserve is in the mixed-mada stage with a strip of Thanduga along the northern boundary, and patches of Tilla in the north-east corner. The south-west corner of the reserve is blank, and there are fairly large blanks alongside the creeks in the northern half of the reserve. The renewed activity of the branch of the Gautami Godavari that flows through Kandikuppa reserve will probably give these forests a new lease of life, if destructive hacking by the neighbouring fisher-folk can be kept under control. The Upputeru reserve has definitely passed beyond the mada-stage, and more than 70 per cent of the area is blank. In the rains the blanks are more or less fresh water swamps ; as the water receeds a fine crop of grass comes up ; and in the hot weather the blanks are parched and cracked fields of clay. The blanks to the west of the Dongapandi are probably suitable for paddy. The growth, which is of the Tilla-Thanduga type, occurs in strips of varying width alongside the streams and creeks. Regeneration is obtained mainly from coppice.

72. *Casuarina.*—Casuarina thrives along the seaboard of Kandikuppa reserve where about 698 acres have been successfully planted. Attempts to raise Casuarina in Coringa Extension reserve have been partially successful, but the planting has been abandoned as it has been considered inadvisable to raise fuel crops artificially in a locality where large areas of natural grown fuel remain unfelled for want of sufficient labour.

73. *Flora.*—The nomenclature adopted in describing the forests of the Lower Godavari division is that given in the Flora of the Presidency of Madras. More recent changes such as *Gossampinus heptaphylla* for *Bombax malabaricum* and *Madusa latifolia* for *Bassia latifolia* have been ignored as they are likely to cause confusion. This procedure agrees with the recommendations made by the Forest Botanist in the " Indian Forester " of October 1931. Two fairly complete lists, showing trees, shrubs and climbers arranged separately, are given in Appendix I (A) and I (B) of this plan. In the first list the species are arranged by natural orders, and in the second list Telugu names are arranged alphabetically.

74. *Animals.*—There is very little wild animal life in the forests of the Lower Godavari division. This is due partly to the scarcity of water, partly to the activity of the Koya and the local shikari, and largely to the complete indifference of the protective staff to the preservation of game. The salt-licks and water-holes in every reserve are known to the local shikari, and the local shikari is known to the forest guard ; yet machans are built over almost every water-hole and salt-lick, and only three offences against the shooting rules have been reported since 1st April 1930. Prescriptions to tighten up the protection of game will be found in Part II of the working plan. Bison are found in the Papikonda reserve where they are specially protected. They are frequently seen on the Papikonda terrace when the fresh grass is sprouting, and at other times of the year, they are found in the neighbourhood of Daravada. There are a few bison in certain reserves of Peddapur range : they are not specially protected. Sambhur are found throughout the division, but they are scarce and are seldom seen or heard. Chital have been seen in the Beddadanole reserve, in the two Devancheruvu blocks, and in the Jeddangi, Labberti and Rajavomangi reserves ; and it is reported that they are found on the flat ground of most of the reserves of Peddapur and Gokavaram ranges. As they are harried by wild dogs and the local shikari they are scarce and shy, and shootable heads are rare. Muntjac are fairly common ; and bears are said to roam erratically over the greater part of the Agency forests but they are seldom seen. Although there are three or four tigers in the Peddapur and Gokavaram ranges at all times of the year, it is doubtful that they live and breed in the forests of the Lower Godavari division. They appear to be strolling animals from across the Vizagapatam border. They beat down as far as Tirumalayapalem reserve and then double back more or less along the same route. If they do breed in this division it is probably in the neighbourhood of Vatangi where water is plentiful and there is good cover. Tigers occasionally enter the Beddadanole reserve from the Nizam's dominions generally in September and October. Panthers roam through all the Agency reserves but they are not common. The most interesting animal in the mangrove forests is the fishing cat—*Felis viverrina*—which is fairly common in Upputeru reserve. It is an exceptionally large cat with black spots on a grey body, a short tail, and facial marking like a tiger. It is reported to kill goats and occasionally dogs, but its chief food is fish.

75. *Birds.*—Both the red jungle fowl—*Gallus ferrugineus*, and the grey jungle fowl—*Gallus sonnerati*—are found in the Lower Godavari division, the Godavari forming the dividing line between the two species. It is reported that both species are found in parts of Polavaram range but this needs confirmation. Peafowl occur throughout the division but are not common ; and the grey and the black partridge are common in scrub jungle and grass. The Indian pelican and two species of curlew are found in the mangrove swamps

throughout the year. In the cold weather duck and teal are very plentiful in the mangrove swamps, notably in Upputeru reserve ; and there are some good snipe grounds both within and adjoining the mangrove forests.

SECTION 2.—INJURIES TO WHICH THE CROP IS LIABLE.

76. *Wind.*—The south-west wind does a certain amount of damage in the young Casuarina plantations chiefly in the year of planting, the plants being whipped by the wind and frequently flattened down. This not only retards growth but results in a fair number of casualties. During the north-east gales tree-tops and branches are frequently broken, and there are occasional wind-falls ; but on the whole winds do little damage.

77. *Drought.*—Drought is believed to be the cause of the casualties that occur in the Casuarina plantations during the hot weather. Excavations have shown that in all such casualties the roots are well above the water-level ; and with the sudden drop in the water-level the shallow root system is left high and dry. Perhaps the shallow root systems are induced by excessive watering or by the bending of the tap-root at the time of planting.

78. *Fires.*—Fire is the chief source of injury in the forests of the Uplands and the Agency, where it has done considerable damage in the past, and it still remains a serious menace. Fire protection started in 1904 by which date the standing crop had been badly damaged, causing the fire-scars, hollow bases, pipes of rot, and other injuries now seen in a large number of mature trees. Several methods of fire protection have been tried. At first fire-lines were cut, and a staff of fire patrols was maintained during the fire season. About ten years later the reward system was introduced, fire-lines being cut as usual, but instead of employing fire patrols the local villagers were entrusted with the protection of the forests, the savings on the pay of the fire patrols being distributed as rewards. Various modifications in the payment of rewards, and the imposition of fines for bad protection were tried, but the villagers showed little response. They accepted the rewards as a matter of course, were indifferent to the fines, and took no active interest in fire protection ; consequently indirect protection was abandoned in Polavaram range in 1926, and throughout the division in 1932. The original system of fire protection has been resumed without fire patrols. Although fire protection has greatly reduced the damage done by fire it is doubtful whether it has been as successful as the following extracts from the district returns show :—

Results of fire protection for the period 1926–33.

	ACS.
Average area specially protected	120,338
Average area burnt	7,786
Percentage of success	93·4 per cent.
Average area under general protection	106,207
Average area burnt	1,680
Percentage of success	98·5 per cent.

Either all the fires that occur in the Agency are not reported, or the areas burnt are underestimated. The chief causes of fire are—

(1) Incendiarism, at the Koya's annual hunting festival, and to obtain good grazing.
(2) The carrying of torches through the forest by drunken Koyas in the fire season.
(3) The smoking out of iguanas, and the collection of honey.
(4) Escape fires from burnt podu plots.

The areas that appear to be particularly susceptible to fires are, the teak lankas and felled coupes of Beddadanole reserve, the teak forests of Kopalli reserve and Kovvada block II, and the bamboo forests throughout the division.

79. *Insects.*—It is only in the Casuarina and Teak plantations that the damage done by insects has been noticed. The common cockchafer grub and the cut-worm do a certain amount of damage in Teak and Casuarina nurseries. The black mole cricket, a species of *Gryllotalpa*, cuts down Casuarina seedlings in the nursery lines and in the new plantations, chiefly in the months of August, September and October, and does considerable damage. The most prominent insect pest in the Casuarina plantations is the bark-eating caterpillar *Arbela tetraonis* which can be identified by the chains of loose excrementitious matter which cover its winding galleries. It makes an ugly mess of the bark but apparently does not cause death or serious injury. Bagworms do a certain amount of damage in the young Casuarina plantations. They are picked off by hand. The larva of the leopard moth, a species of *Zeuzera*, does a little damage to teak saplings by boring into the pith and tunnelling upwards. The teak defoliator *Pyrausta machaeralis* is common in the Polavaram range.

80. *Wild animals.*—Sambhur and chital do a little damage, chiefly in the teak plantations ; but these animals are so scarce that the damage is neglibile.

81. *Climbers.*—Next to fires, climbers do the most damage. They are particularly plentiful in the teak lankas of Beddadanole reserve and in the lankas and valleys of Papikonda reserve and Kovvada block II where *Butea superba, Bauhinia vahlii,* and *Zizyphus enoplia* attain large dimensions and do considerable damage. In the fuel forests *Acacia Caesia (intsia), Pterolobium indicum, Cæsalpinia crista, Abrus precatorius* and other climbers straggle over the coppice : and a large climber—*Leptodenia reticulata*—does some damage in the Casuarina plantations at Kandikuppa.

82. *Grazing.*—Grazing does little damage in the forests of the Uplands and the Agency ; but browsing, in the guise of grazing, does considerable damage in the mangrove forests. Buffaloes roam unattended throughout these forests and their chief food is the leaves of the four Madas—the principal species,—the leaves of Kalinga, the climber Nalla-theega and the large blue flowers of Alchi. In the hot weather fresh water is not obtainable in the mangrove swamps, and cattle owners convey water in boats to certain watering places within the reserved forest where they maintain water troughs and store water in the large earthen vessels. The buffaloes collect at these watering places where the ground is trodden hard, and all edible growth in the neighbourhood is destroyed. Cattle frequently break into the young Casuarina plantations at Kandikuppa and do a certain amount of damage.

83. *Illicit fellings.*—Illicit fellings are rife in Kandikuppa and Upputeru reserves. The fishermen of Pandipallam and Pora villages in Kandikuppa reserve are particularly prone to thieving fuel ; and in Upputeru reserve thefts are most common along the Kotachedu in the neighbourhood of Kotapusalmari village. It is reported that thefts are fairly common in the outlying reserves of the Uplands such as Sarlanka, Raghavapatnam and Anantaram. Elsewhere little damage is done by illicit fellings.

CHAPTER III.—UTILIZATION OF THE PRODUCE.

SECTION 1.—AGRICULTURAL CUSTOMS AND WANTS OF THE POPULATION.

84. *The people.*—In the Lower Godavari division there are three main classes of people whose customs and wants bear on forest management : the Koyas and Reddis of the Agency, the agriculturists of the Uplands and the Delta, and the fishermen in the villages adjoining the coastal reserves.

85. *The Koyas and Reddis of the Agency.*—The Koyas of the East Godavari Agency are believed to be a section of the great Gond tribe of the Central Provinces. The Koyas have a language of their own, but most of the men are able to speak crude Telugu. They are mainly agriculturists ; but when not engaged in agriculture they extract bamboos, collect minor forest products—chiefly tamarind, and do other manual labour. Like most jungle tribes, they are lazy and indolent, and work only when they must. The hot weather is their festive season, for then the crops have just been harvested, the sap of the palmyra and sago palms is in full flow, and there is plenty to eat and drink ; above all, the anopholes mosquito is comotose in the dry hot months. At this time, they marry, dance, organize shikar drives, set fire to the forest, fatten themselves against the lean months that are to follow, and indulge in other little joys of life. They dislike work at this season and are frequently intoxicated, but they are lively and cheery. At other seasons they are dull, apathetic, and uninteresting. The Reddis are not unlike the Koyas and their habits are more or less the same. They are found chiefly in the northern half of Polavaram range and in the Rampa Agency. The type of agriculture adopted by the Agency tribes is a form of shifting cultivation known as *podu.* There are two forms of podu : ordinary or *chilaka podu,* and hill or *konda podu.* The former is on flat ground and is cultivated for several years, while the latter is on hill slopes and is generally abandoned after one or two crops are taken off the land. The following brief description of podu cultivation is taken from the Gazetteer of the Godavari district : "In February or March, the jungle trees and bushes are cut down and spread evenly over the portion to be cultivated, and when the hot weather comes on they are burnt. The ashes act as a manure, and the cultivators also think that the mere heat of the burning makes the ground productive. The land is ploughed once or twice in *chalaka podu* before and after sowing, but not at all in *konda podus.* The seed is sown in the *mrigasra karti.* Hill cholam and samai are the common crops. The former is dibbled into the ground." The wants of the Koyas and Reddis are : land for podu cultivation, small fuel and timber for domestic purposes, bamboos for building their huts and other structures, grass for thatching their huts and grazing for their cattle. Podu cultivation is strictly prohibited in the reserved forests, but ample provision has been made for this purpose outside the reserved forests ; and these lands supply all the forest produce that they need. The Koyas and Reddis are allowed free grazing in the reserved forests in accordance with G.O. No. 1061, dated 18th September 1895.

86. *The agriculturists of the Uplands and the Delta.*—The cultivation of paddy, sugarcane, or tobacco occupies the great majority of the agriculturists of the Delta and the Uplands. Their chief demands on the forests are : large timber for house construction, carts and boats ; small timber for huts and agricultural implements ; fuel for domestic purposes ; bamboos for sugarcane props, house building and other purposes ; and grazing accommodation for their cattle when crops are on the ground. Large timber is obtained from the markets at Cocanada and Rajahmundry ; small timber and fuel is obtained from private lands, zamindari forests, unreserves, and from forest contractors ; bamboos are purchased from the nearest markets, or removed from the forests on permits issued by forest contractors ; and when the crops are on the ground, cattle are sent to graze in the forests of the Uplands and the Agency or in the mangrove swamps.

87. *The fishermen in the neighbourhood of the coastal forest.*—The villages bordering on the mangrove swamps are occupied chiefly by fishermen. There are a few agriculturists and traders at Coringa and along the right bank of the Upputeru ; and a few people at Neelarevu in Kandikuppa reserve and elsewhere live by collecting sea-shells ; but the main occupation is fishing. A small quantity of fish is sold fresh, but the bulk of the catch, both fish and prawns, is smoked, salted, or dried, and sold to traders. The fishermen need teak for boat building ; timber posts for masts and *katlus* ; small timber for house construction and other purposes ; palmyra trees for dug-outs—chiefly near Upputeru reserve ; bamboos for poling boats, fishing stakes, sails, and other purposes ; gedara bark for dying fishing nets, grass for roofing, etc ; and fuel for domestic purposes and smoking fish. Teak and timber poles are obtained from the nearest timber markets, palmyra trees are obtained from private lands, but the rest of their requirements is obtained from the mangrove forests.

SECTION 2.—MARKETS AND MARKETABLE PRODUCTS.

88. *Markets for timber and bamboos.*—The chief markets for timber and bamboos are Rajahmundry, Cocanada, Ellore, Samalkot, Nidadavole and Bhimavaram ; and a small quantity of timber and bamboos is sold at Yelleswaram, Peddapuram, Polavaram, Kannapuram, Jangareddigudem and elsewhere. Rajahmundry is the largest timber market in South India. Over a million cubic feet of timber pass through the Rajahmundry market in normal years, but at present—1933—the timber market is very dull due chiefly to the heavy drop in the price of paddy. A note on the Rajahmundry market will be found in Appendix VII of this working plan. Teak sells readily at all the timber markets. Next in order of preference are, rosewood, *Pterocarpus marsupium*, *Terminalia tomentosa*, *Adina cordifolia* and *Soymida febrifuga*. Recent attempts to sell miscellaneous timber by auction at Yelleswaram have not been as successful as was expected, due chiefly to the trade depression. When commodity prices improve and there is more money in the villages, it ought to be possible to establish timber markets in the large villages on the outskirts of the Agency.

89. *Markets for fuel and minor products.*—Cocanada absorbs all the fuel obtained from Coringa and Coringa Extension reserves and the Kandikuppa Casuarina plantation. The fuel outturn from the Kandikuppa mangrove forests is barely sufficient to meet the demand from the local fishing villages. The fuel from the Upputeru mangrove forests is exported to Penukonda, Palacole Bhimavaram and other towns of the West Godavari district. Cocanada, Rajahmundry, Samalkot, Peddapuram and the adjoning villages absorb the yield from the Mallavaram, Sudikonda and Tirumalayapalem coupes. The produce from the two Devancheruvu blocks is sold at Rajahmundry. There is no demand for fuel in the Agency as the population is small and there are extensive unreserves. It is unlikely that new markets for fuel will arise during the period of this working plan. The minor forest produce that is not leased out to contractors—chiefly tamarind—is sold at the villages on the outskirts of the Agency.

90. *Classification of forest produce.*—Timber is commonly classified as follows throughout the division :—

Classification.	Description.		Remarks.
	Girth.	Length.	
(1)	(2)	(3)	(4)
Vasam	Below 18 inches	12 to 18 feet.	Small pieces 2–4 feet in girth and above 12 feet in length are called Tunakas.
Bazoo	18 to 24 inches	18 to 24 feet.	
Dulam	24 to 36 inches	Do.	
Karra	36 to 48 inches	Do.	Tunakas of teak and rosewood alone are saleable.
Palaka	Above 48 inches	Do.	

Bamboos are classified as follows :—

(1) *Modati-potu-vasam.*—Thin to medium size *Dendrocalamus strictus,* cut low, with the bottom usually solid or nearly so. They are used mainly for sugarcane props and plantain tree props ; and to some extent for house building. Three hundred go to a cart-load.

(2) *Medara-veduru.*—Thick, fairly even-grown *Dendrocalamus strictus.* The outer skin should not be damaged. One hundred and forty go to a cart-load.

(3) *Baru veduru.*—*Dendrocalamus strictus* of medium thickness, used mainly for house building. One hundred and eighty go to a cart-load.

(4) *Mollem Baru veduru.*—*Bambusa arundinacea* of medium thickness, used mainly for house building. One hundred and eighty go to a cart-load.

(5) *Sandanam kanathi.*—Lower lengths of *Dendrocalamus strictus,* usually over 6 inches in girth, used mainly for house building. One hundred and forty go to a cart-load.

(6) *Mollem kanathi.*—*Bambusa arundinacea.* Lower lengths of *Bambusa arundinacea,* usually over 6 inches in girth, used mainly for house building. One hundred and forty go to a cart-load.

(7) *Kavidi baddalu.*—Shoulder shafts of split *Bambusa arundinacea* used for carrying loads. Two hundred and forty go to a cart-load.

(8) *Thotha gedalu.*—Thick, full length, *Dendrocalamus strictus,* used for poling boats. One hundred and forty go to a cart-load.

(9) *Mulakala kanchu.*—Thin sticks of *Dendrocalamus strictus* used for driving cattle. One thousand and two hundred go to a cart-load.

(10) *Bana karralu.*—Lathies of *Dendrocalamus strictus.* Two hundred and forty go to a cart-load.

Fuel is classified according to species. There are three classes of fuel on the Rajahmundry market : Chiruman—*Anogeissus latifolia* ; Tumma—*Acacia arabica,* and Marjabi, a common name for all other fuel. On the Cocanada market six classes are recognized :—Mada—*Avicennia* ; Tilla—*Excoecaria agallocha* ; Sarugudu—*Casuarina equisetifolia* ; Tumma—*Acacia arabica,* and Marjabi—a common name for mixed jungle fuel. Mada fuel is the most expensive, it is reported to be immune from white ants, and can be stored for long periods without deteriorating.

The following are the chief minor products of the Lower Godavari division :—Tamarind, Myrabolams, Thangedu bark—*Cassia auriculata,* Rela bark—*Cassia fistula,* Musti seeds—*Strychnos nux-vomica,* Kanuga seeds—*Pongamia glabra,* Gedara bark—*Ceriops roxburghiana,* Vasantagunda—the fruit of *Mallotus philippinensis,* Jagi leaves—*Woodfordia floribunda.*

SECTION 3.—LINES OF EXPORT.

91. *Means of communication.*—In the Lower Godavari division produce is transported by rail, road and water. The north-east line of the Madras and Southern Mahratta Railway runs across the division from south-west to north-east passing through Ellore, Nidadavole, Rajahmundry, Samalkot, Pithapuram and Tuni ; with branches to Cocanada, Kotipalli, Bhimavaram and Narasapur. The railway is seldom used for transporting forest produce within the district : this is done chiefly by road and water. The main arterial roads for the transport of forest produce are—

(*a*) The Madras-Calcutta trunk road which runs more or less parallel to the railway, with a break at the Godavari between Kovvur and Rajahmundry.

(*b*) The metalled road from Cocanada through Samalkot and Peddapuram to Jaggampeta on the Madras trunk road.

(*c*) The metalled road from Erravaram, on the Madras trunk road, to Yelleswaram, Jaddangi, Rajavomangi, and the district border. There is a break on this road between Jaddangi and Tantikonda, which is in course of construction and will soon be complete.

(*d*) The road from Kovvur, on the right bank of the Godavari, to Jangareddigudem.

Feeder roads and cart-tracks link the reserved forests with the main arterial roads. Along the river, on the coast, and in the delta, forest produce is transported by water.

92. *Export routes in the Peddapuram and Gokavaram ranges.*—All forest produce in these two ranges is transported by road. The fuel coupes and bamboo blocks in Sudikonda, Tirumalayapalem and Mallavaram reserves are tapped by forest roads, which debouch on a metalled road running from Gokavaram to Jagampeta alongside these three reserves. The remaining workable forests are tapped by the Addatigala-Yelleswaram road, the Ramanayyapetta-Lododdi forest road and the arterial road from the district border to Erravaram.

93. *Export routes in the Rajahmundry range.*—The entire yield from the two Devancheruvu blocks is transported to Rajahmundry along the Madras road. All other produce from the Rajahmundry range is transported by water. The Coringa and Coringa Extension reserves supply the Cocanada market by way of the tidal creeks, the Gaderu, the

Coringa river, and the Coringa backwater. The fuel from the Kandikuppa reserve is exported along the Godavari to Yanam, and thence to Cocanada along the Coringa river. The fuel from Upputeru reserve is exported along the Upputeru river, and the Bhimavaram and Narasapur canals.

94. *Export routes in the Polavaram range.*—In the Polavaram range, forest produce is transported partly by road and partly by water. Timber and fuel from the Beddadanole coupes are carted along the Ankhanagudem-Bothappagudem forest road to Mulagalampalle, and thence along rough cart-tracks to Jangareddigudem, from which place there are good metalled roads to Kovvur, Ellore, Nidadavole and other small markets. The Ankhanagudem-Ravuthugudem forest road provides an alternate extraction route, but at present the road is cut in places and in need of repairs. Timber and bamboos from Kopalli reserve and Kovvada block I are transported along the Munjulur-Kannapuram forest road via Puliramudugudem, or along other rough cart-tracks, to the metalled road which links Polavaram with the arterial road from Jangareddigudem to Kovvur. The Godavari river is the chief extraction route for the bamboos and timber from Papikonda reserve and Kovvada block II. A list of forest roads in the division showing cost of construction and expenditure on maintenance during the past ten years will be found in Appendix V.

SECTION 4.—METHODS OF EXPLOITATION AND THEIR COST.

95. *Agency of exploitation.*—Timber, fuel and bamboo coupes are invariably sold standing to contractors who are required to fell and remove the produce from the leased coupes within a specified time—usually one year—and in accordance with the conditions laid down in a written agreement executed by them before they commence work in the coupes. Security deposits are invariably taken from the contractors as a safeguard against default, or breaches of their agreements. Clear-felling in areas selected for experimental plantations, and thinning in the Casuarina plantations, are carried out by departmental agency. In remote areas, where contract working is not yet established, departmental extraction is necessary. This is confined to timber extraction in the remote reserves of Peddapuram range, and in Papikonda reserve and Kovvada block II of Polavaram range.

96. *Methods of felling and extracting timber with costs.*—The timber coupes of Beddadanole and Kopalli reserves are the only areas that have been regularly worked for timber during the past ten years. The coupes are sold standing to contractors who clear-fell the whole coupe but only convert and remove the saleable timber. The rest is burnt. The average cost per acre for clear-felling the coupes and converting the saleable timber is reported to be Rs. 17 per acre. Figures are not available to show the cost per cubic foot. The cost of piling the slash and burning these coupes is reported to average Rs. 3 per acre. Carting timber costs 2 annas per cubic foot for 10 miles on rough roads, and 20 miles on metalled roads. The following is the cost of rafting timber on the Godavari, from the Koratur and Sivagiri revus to Rajahmundry :—

Timber over 3 feet in girth	Rs. 30 per 100 logs.
,, from 2 to 3 feet in girth	Rs. 20 ,,
,, from 1½ to 2 feet in girth	Rs. 12–8–0 ,,

The Forest Engineer estimates that the cost of felling and extracting timber in Papikonda reserve and Kovvada block II, under departmental supervision, will be as follows :—

	Per cubic foot. A.	P.
(*a*) Felling and logging	0	6
(*b*) Dragging from stump to road : an average lead of half a mile	2	0
(*c*) Carting to the head of the slide : an average lead of 5 miles	2	0
(*d*) Working the logs down a timber skidway, collecting and stacking on the river bank	2	0
Total estimated cost ..	6	6

97. *Methods of felling and extracting fuel, with costs.*—The fuel coupes throughout the division are sold standing to contractors. In the coupes of the Uplands and the Agency, felling and stacking is done on piecework contract, the rate in Peddapuram and Gokavaram ranges being 6 to 7 annas per stack measuring 9′ × 3′ × 3′, or 81 cubic feet approximately equivalent to one ton. In the two Devancheruvu blocks of Rajahmundry range the rate for stacks of the same size is 12 annas. The cost of carting ranges from As. 1-3 to As. 2–6 per cart-load per mile, according to the locality and the season. In the two

Devancheru blocks the stacks of fuel are sold to purchasers at the coupe, the present price being Rs. 2–8–0 per stack. In the mangrove forests of Coringa reserve the felling, extraction and transport, including stacking at the depots on the canal bank at Cocanada are done on contract at a fixed rate per putti of 500 lb. The rate varies with the distance and the lead, averaging about 12 annas per putti. In the Upputeru reserve the current rate is 10 annas to 12 annas per putti for felling and delivery at the depot at Bhimavaram. A putti is equivalent to 500 lb.

98. *Methods of felling and extracting bamboos with costs.*—The bamboo coupes are leased annually to contractors, who work the coupes themselves in parts of the division, chiefly in Polavaram range, but more commonly issue permits for the removal of bamboos by the consumers themselves or by sub-contractors. In the Polavaram range bamboos are felled and transported to the river side or cart-tracks by Koyas and Reddis. The total number of men available for this purpose in Papikonda and Kopalli reserves and the two Kovvada blocks is estimated at 400. The current rates for felling, transporting and stacking on the river bank or road side are as follows :—

Medara bamboos	Rs. 15 per 1,000.
Mollem (Bambusa)	Rs. 30 per 1,000.
Sandanam (Dendrocalamus)	Rs. 15 per 1,000.
Modati-potu-vasam (Sugarcane props)	Rs. 7–8–0 to Rs. 10 per 1,000.

About 200 carts are available in the villages in the neighbourhood of Koppalli reserve and Kovvada block I, for carting bamboos from these two reserves to the revus at Patisam or Thallapudi. The carting rates vary with the class of bamboo and the distance ; the average rates are as follows :—

Mollem bongu	Rs. 20 to Rs. 25 per 1,000.
Sandanam bongu	Rs. 15 to Rs. 20 per 1,000.
Modati-potu-vasam	Rs. 10 to Rs. 12 per 1,000.

The current rates for rafting from Pattisam and Thallapudi to Rajahmundry are as follows :—

Class of bamboo.	Rate per 1,000 bamboos. Depot rent.	Transport to water.	Rafting.	Total cost per 1,000 bamboos.
	AS.	RS. A. P.	RS. A. P.	RS. A. P.
1 Modati-potu-vasam	4	0 8 0	1 12 0	2 8 0
2 Sandanam	6	1 2 0	3 0 0	4 8 0
3 Mollem	8	2 12 0	7 0 0	10 4 0

No land rent is payable for the depots at Koratur and Sivagiri and the total cost of rafting to Rajahmundry averages as follows :—

Modati-potu-vasam	Rs. 3 per 1,000
Sandanam	Rs. 6 per 1,000.
Mollem	Rs. 10 per 1,000.

In Peddapuram and Gokavaram ranges the rates for felling bamboos and transporting them to the road side is as follows :—

Modati-potu-vasam	Rs. 10 per 1,000.
Sandanam	Rs. 12 to Rs. 15 per 1,000.
Mollem	Rs. 15 to Rs. 17-8-0 per 1,000.

The carting rates range from As. 1–3 to As. 2–6 per mile and the rate per 1,000 depends on the class of bamboo and the distance carted.

SECTION 5.—PAST AND CURRENT PRICES.

99. *Timber.*—The only information that is available regarding the prices obtained in the past for timber from the forests of the Lower Godavari division is as follows :—

(*a*) In the working plan for Peddapuram range—1906, the price of miscellaneous timber at the coupes is quoted at Rs. 4 per cart-load.

(*b*) In the working plan for the Rajahmundry range—1919, the price of timber at the coupes is listed in four classes :—

Nalla mada	Rs. 4 per cart-load.
Chiruman, Konda-thangedu, Billudu and Kodisa.	Rs. 3 ,,
Other timber	Rs. 2 ,,
Poles—Miscellaneous	Rs. 1-8–0 per 100.

The only areas that have been worked regularly for timber during the past ten years are the coupes of Beddadanole and Kopalli reserves, which were sold standing to contractors. The prices realized for the Beddadanole coupes ranged from Rs. 20 to Rs. 42 per acre, averaging Rs. 29, while the coupes in Kopalli reserve fetched Rs. 19 to Rs. 44 per acre, averaging Rs. 24. An attempt was made to correlate the prices paid for these coupes with the outturn reported by the contractors, but the results were found to be very erratic and of no value. As the prices paid for these coupes depended largely on the quantity of teak available and this varied greatly, they afford no indication of the movement in the price of timber. The current prices of timber on the Rajahmundry market are as follows :—

Classification.	Teak.		Other timber.		Remarks.
	Price.	Unit.	Price.	Unit.	
	RS.		RS.		
Vasam	35 to 50	Per 100	15 to 25	Per 100	(1) All timber is sold in the log ; and the prices vary with the quality.
Bazoo	100 to 150	,,	75 to 100	,,	
Dulam	6 to 10	Each	3 to 4	Each	
Karra	25 to 30	,,	7 to 10	,,	(2) The prices have dropped heavily during the past four years, owing to the drop in commodity prices, chiefly paddy (see note on the Rajahmundry market—Appendix VII).
Palaka	30 to 60	,,	15 to 25	,,	
Tunaka	Varies according to quality.		Unsaleable.		

Note.—Rosewood is sold according to size and quality. It is scarce on this market.

100. *Bamboos*.—The bamboo coupes are sold standing to contractors, the prices obtained depending on the quantity of bamboos available and the situation of the coupes. The highest prices obtained during the past ten years were Rs. 8,050 for coupe III of Kovvada block I, in 1924-25; Rs. 7,120 for coupe IV, comprising Sudikonda and Tirumalayapalem reserves, in 1932–33; and Rs. 6,875 for coupe III, Lakkonda reserve, in 1930–31. The average price for which a bamboo coupe is sold is about Rs. 3,000. The working plan for Polavaram range—1918, quotes the following selling prices for bamboos :—

Modati-potu-vasam	Rs. 25 to 40 per 1,000.
Medara-Veduru	Rs. 60 to 75 per 1,000.
Baru-Veduru	Rs. 50 to 90 per 1,000.
Sandanam and Mollem Kanathi	Rs. 60 to 100 per 1,000.

The prices of the same four classes of bamboo at Rajahmundry in 1927 and 1932 were as follows :—

Class of bamboo.	Price per 1,000 culms.	
	1927.	1932.
Modati-potu-vasam	Rs. 30 ..	Rs. 14 to 18.
Medara-Veduru	Rs. 50 to 90	Rs. 40 to 50.
Baru-Veduru	Rs. 70 to 100 ..	Rs. 60 to 80.
Sandanam and Mollem Kanathi ..	Rs. 120 to 150.	Rs. 75 to 150.

101. *Fuel*.—There has been a downward movement in fuel prices at Cocanada during the past five years, in reaction to the general slump in commodity prices. The following statement shows the prices of fuel at Cocanada from 1917 to 1932 :—

Kind of fuel.	1928.	1929.	1930.	1931.	1932.
	PER TON.	PER TON.	PER TON.	PER TON.	PER TON.
Mada	Rs. 14 to 18 ..	Rs. 13-8 to 17-7.	Rs. 13 to 15-12.	Rs. 10-2 to 12-6.	Rs. 9 to 11-4.
Tilla	Rs. 9 ..	Rs. 7-14 ..	Rs. 6-12 ..	Rs. 6-3 ..	Rs. 5-1.
Casuarina	Rs. 16-5 to 21-6.	Rs. 15-12 to 21-6.	Rs. 13-8 to 20-4.	Rs. 12-6 to 13-8.	Rs. 11-4 to 12-6
Jungle-mixed ..	Rs. 13-8 to 15-12.	Rs. 13-8 to 15-12.	Rs. 9 to 13-8 ..	Rs. 9 ..	Rs. 7-5 to 11-4.
Babul	Rs. 16-14 ..	Rs. 9 to 20-4.	Rs. 18 ..	Rs. 9 to 13-8 ..	Rs. 9.

Note.—The range of prices for each species is on account of size of the fuel.

The price of fuel at Rajahmundry in 1933 was :—

1. Chiruman—*Anogeissus latifolia*	Rs. 1-12 per candy.
2. Tumma—*Acacia arabica*	Rs. 1-10 ,,
3. Marjabi—Other species	Rs. 1-6 ,,

The following statement shows the prices obtained for the fuel coupes of the Lower Godavari division during the past 10 years :—

Year.	Price per acre obtained for the coupes in						
	Coringa and extension reserves.	Kandikuppa reserve.	Upputeru reserve.	Sudikonda reserve.	Tirumalayapalem reserve.	Mallavaram reserve.	Devancheruvu reserve.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.
1923–24 ..	..	22 5	..	13 12	27 4	32 5	90 5
1924–25 ..	26 0	7 12	2 8	22 4	48 11	25 5	36 9
1925–26 ..	28 15	7 5	1 11	21 12	18 15	20 14	43 8
1926–27 ..	29 12	15 3	8 7	32 8	23 11	18 14	56 14
1927–28 ..	32 4	11 6	4 15	26 1	15 13	15 3	37 8
1928–29 ..	25 12	20 0	5 7	17 2	14 4	15 6	58 2
1929–30 ..	25 15	25 12	2 8	22 12	27 0	18 8	73 15
1930–31 ..	20 15	35 11	3 12	18 7	19 15	13 7	51 13
1931–32 ..	9 12	11 9	2 0	15 3	13 6	11 4	47 10
1932–33 ..	15 4	4 1	2 5	27 15	11 8	10 7	Not at hand.
Average ..	23 12	16 1	3 12	21 12	22 1	18 3	55 2

CHAPTER IV.—STAFF AND LABOUR SUPPLY.

SECTION 1.—STAFF.

102. The following statement shows the sanctioned establishment for the Lower Godavari division. It does not include the special staff employed in the Rampa Agency but includes all permit issuing Gumastahs and Tanadars in the River range.

Classification of staff. (1)	Rank or post. (2)	Sanctioned strength. (3)	Remarks. (4)
	A. PERMANENT ESTABLISHMENT.		
1 Controlling staff ..	District Forest officer ..	1	The District Forest Officer is usually a Deputy Conservator.
2 Executive staff ..	Range officers	5	A ranger usually holds charge of each of the five ranges in the division, namely, Polavaram, Rajahmundry, Peddapur, Gokavaram and the River range.
3 Protective staff ..	Foresters	19	The sanctioned strength in each grade is— First grade .. .. 1 Second grade .. .. 3 Third grade .. .. 4 Fourth grade .. .. 5 Fifth grade .. .. 6 Total .. 19
	Forest guards	54	There are 54 beats in the division which are distributed as follows :— Polavaram range .. .. 11 Rajahmundry range .. 8 Peddapur range .. .. 15 Gokavaram range .. 14 River range .. .. 6 Total .. 54 The sanctioned strength in each grade is— First grade .. .. 3 Second grade .. .. 6 Third grade .. .. 18 Fourth grade .. .. 27 Total .. 54

Classification of staff. (1)	Rank or post. (2)	Sanctioned strength. (3)	Remarks. (4)

A. PERMANENT ESTABLISHMENT—*cont.*

Office establishment—			
(*a*) District Forest Office.	Head Clerk	1	
	Accountant	1	
	Second clerk	1	
	Third clerk	1	
	Fourth clerk	1	
	Fifth clerk	1	
	Draftsman	1	
	Typist	1	
	Peons	4	
(*b*) Range Offices	Range clerk	4	
	Peons	4	

B. TEMPORARY ESTABLISHMENT.

1 Protective	Forest watchers	54	One watcher for each of the 54 beats.
2 Buildings	Bungalow watchers	2	One at Yelleswaram and the other at Gokavaram.
	Sweepers	2	One for Mulagalampali rest-house and the other for Ravigudem rest-house.
3 Office establishment	Range peons	4	One each for Polavaram, Rajahmundry, Peddapur and Gokavaram ranges.
4 Permit-issuing and checking staff.	Permit gumastahs	11	The gumastahs are distributed as follows :—Peddapur range 3, Gokavaram range 4, River range 3, and one is employed at the District Forest Office. The sanctioned scale is as follows :— 2 gumastahs on Rs. 35. 4 do. Rs. 30. 5 do. Rs. 22-8.
	Tanahdars	18	The sanctioned scale is as follows :— 2 tanahdars on Rs. 12-8. 2 do. Rs. 10-8. 13 do. Rs. 9. 1 tanadar on Rs. 8. They are distributed as follows :— Rajahmundry range 4, Peddapur range 3, Gokavaram range 3, Polavaram range 1, River range 7.
5 Launches and boats—			
(*a*) The steam launch "Thistle."	Driver	1	Pay Rs. 30.
	Serang	1	Do. Rs. 27.
	Fireman	1	Do. Rs. 14-8.
	Lascar	1	Do. Rs. 13-8.
	Lascar	2	Do. Rs. 12.
(*b*) The outboard motor boat "Avicennia."	Driver	1	Do. Rs. 18.
(*c*) District Forest Officer's staff boat.	Serang	1	Do. Rs. 12.
(*d*) Other boats	Serang	1	Do. Rs. 12.

SECTION 2.—LABOUR SUPPLY.

103. Sufficient labour is available throughout the division except in parts of Polavaram range and in the mangrove swamps of Coringa, Coringa extension, and Upputeru reserves. There is no difficulty about labour in Peddapur and Gokavaram ranges. The position in Polavaram and Rajahmundry ranges is as follows :—

(*a*) *Polavaram range—*

In Beddadanole and Marlagudem reserves, labour is plentiful.

In Kopalli reserve and Kovvada block I, labour is sufficient in the southern half and insufficient in the northern half.

In Papikonda reserve and Kovvada block II, labour is scarce.

The total labour force available for work in the reserved forests of Polavaram range is estimated at about 400 local men, and about 100 men from the adjoining villages.

(*b*) *Rajahmundry range—*

In Kandikuppa reserve and the two Devancheruvu blocks, labour is plentiful.

In Coringa and Coringa extension reserves there is a shortage of labour for work in the mangrove swamps. This work is done by a special class of labourers. The total force is estimated at 150 to 200 men. The shortage of labour has a direct bearing on the management of these forests.

In Upputeru reserve the labour available is barely sufficient for working the annual coupes.

The bulk of the work in the division is done on piece-work contract. The current rates for labourers employed on daily wages are as follows :—

Polavaram range	Men 4 annas.
Rajahmundry range	Men 4 annas to 6 annas and women 2 annas 6 pies to 3 annas.
Peddapur range	Men 4 annas and women 2 annas to 2 annas 6 pies.
Gokavaram range	Men 4 annas and women 2 annas 6 pies to 3 annas.

CHAPTER V.—PAST SYSTEMS OF MANAGEMENT.

SECTION 1.—GENERAL HISTORY OF THE FOREST.

104. *Early history.*—Very little is known of the history of the forests of the Lower Godavari division before they came under British rule, although the adjoining country had been under various forms of civilization for nearly twenty centuries. Rock inscriptions found in the Kistna district and elsewhere show that Asoka subdued the Andhras and conquered Kalinga—which included the present Godavari district—in the year 260 B.C. Later, the Andhras regained their country and remained in power until about 220 A.D., when they were defeated by the Palluvas. The Palluvas remained in possession until about 615 A.D., when they, in turn, were subdued by the Chalukyas in an invasion from the north-west. Other landmarks in the early political history of the Godavari district are the Chola invasion at the end of the tenth century ; the first Muhammadan invasion of 1323 ; the conquest of the district in 1515 by Krishna Deva, of the Vijayanagar kingdom, whose capital was at Hampe in the present Bellary district ; and the Moghul occupation in 1540. The country remained under Muhammadan rule until the Northern Circars were ceded to the East India Company in 1765. Civilization, without a forest policy, has invariably led to the destruction of forests ; and it is probable that in these early years large tracts of forest were laid bare, the destruction being limited chiefly by accessibility ; whereas, in the troublous times, when civilization receded and the people fled, the jungle took possession of all abandoned land. There is no doubt that a portion of Beddadanole reserve was once under cultivation ; and elsewhere in the division the best timber forests are on the sites of abandoned villages. Meanwhile, malaria, the curse of the Agency, has helped to check the invasion and destruction of the forests, and has played no small part in conserving the forests of the Lower Godavari division.

105. *The first century of British rule.*—The French established themselves in the Northern Circars ahead of the English, but their influence was completely destroyed by Colonel Forde's decisive victory at Condore, near Pithapuram, in 1758. In 1765, the Northern Circars were ceded to the East India Company by the Emperor of Delhi, and for the next four years the country was leased out. It was not till 1769 that it came under direct British rule. In 1775 a Committee of Circuit, composed of five members of the Council of Fort St. George, was appointed by the Court of Directors of the East India Company to enquire into the state of the Northern Circars ; and in 1794 the Godavari district was placed under a Collector. During the first century of British rule the Government was concerned chiefly with the subjugation of hostile Zamindars, the suppression of rebellions, the revenue settlement of the district, and the establishment of peace and order ; and, although the Committee of Circuit referred to the flourishing trade in timber along the Godavari river as far back as 1786, forest conservancy was not introduced until nearly a hundred years later.

106. *Forest conservancy.*—In 1874 the Bhadrachalam taluk was transferred from the Central Provinces to Madras and added to the Godavari district. In 1876–77 Mr. Boileau, Deputy Conservator of Forests, selected 68 square miles of forest in the Bhadrachalam taluk for reservation ; but forest conservancy was not started in the area covered by this working plan until about 1888. In 1877 Dr. Brandis, who was then in the Madras Presidency advising the Government on its future forest policy, drew attention to the fact that grazing, fire, indiscriminate cutting, and the shifting cultivation practised by the hill tribes, were ruining the forests ; and he recommended that forest conservancy should be abandoned unless Government was prepared to introduce a Forest Act and sanction the reservation of large compact blocks of forest. On the 1st January 1883 the Madras Forest Act came into force ; and of the thirty-six reserves included in this working plan, thirty-five were constituted reserved forests between 1891 and 1900, while the Coringa extension reserve was notified in 1921. The date of reservation of each reserve will be found in paragraph 41.

107. *Forest settlement.*—The settlement of these forests under Chapter II of the Madras Forest Act was complicated not only by claims to proprietary ownership, but also by the habits and susceptibilities of the Koyas and Reddies. Although these hill tribes possessed few sustainable rights over the forests, they had, from time immemorial, enjoyed and abused an unrestricted freedom to fell, clear, and burn whatever they chose; and, for political reasons, it was considered necessary to deal with them cautiously. The shifting cultivation practised by the Koyas and Reddies, known as *podu* cultivation, has already been referred to in Chapter III. Not only were large areas of forest destroyed for podu, but escape fires from the burnt clearings swept over many square miles of forest every year. Therefore, for conservancy to be thorough, it was necessary to exclude all podu cultivation from the limits of the reserved forests, and to curtail the privileges of the hill tribes within such areas. In the earlier stages of forest settlement in the Polavaram and Yellavaram taluks, the Agency Officers were of opinion that reservation had been too wholesale, allowing insufficient jungle in the neighbourhood of villages for the extension of cultivation, and the supply of timber for agricultural implements and domestic purposes. In 1893 Mr. A. T. Arundel, a member of the Board of Revenue, visited the district to investigate this matter. He found that the habits of the hill tribes had received inadequate consideration; and, without laying down hard and fast rules, he indicated the broad principles to be observed in the selection of forests for reservation. Thereafter both settlement and reservation proceeded smoothly. At present the land at the disposal of the Koyas and Reddies for podu cultivation and other purposes is more than they need, particularly in the Polavaram range, where the Tiyyamamidi enclosure has been abandoned, and the area under Konda podu has been reduced appreciably.

108. *Reserved forests under panchayat management.*—In consequence of the re-classification of the forests of the Madras Presidency, four reserves in the Polavaram range, namely, Barrinkalapadu, Darbhagudem, Darbhagudem Extension, and Jilugumilli were handed over to panchayat management in August 1926; and fourteen reserves in the Rajahmundry Range, namely, Bandamcherla, Barrikonda and Extension, Ramasingavaram and Extension, Thadikalapudi, and Ungutur blocks I and II were handed over to panchayat management in September 1927; Nallacherla, Erraguntapalli, and Upputeru block I on November 1927; Kogida, Murari and Ramaswaram in July 1928; while Chintalapudi and Velagalapalli reserves had already been handed over to panchayat management before the Ellore range was transferred to the Lower Godavari division.

109. *The special unreserves.*—In 1926 five blocks of unreserved land were declared to be 'special unreserves' under rule 5 of the general rules under section 26 of the Madras Forest Act. These lands are adjacent to reserved forests, and their situation and area are as follows :—

	ACS.
(1) The Rajavommangi special unreserve	466
(2) The Jaddangi special unreserve	654
(3) The Vatangi special unreserve	1,353
(4) The Virabhadrapuram special unreserve	124
(5) The Dormamidi special unreserve	425
Total area ..	3,022

The special unreserves are under the control of the Forest department and are closed to podu cultivation, goats, and the removal of timber of reserved and classified species. Except for these prohibitions, grazing and the removal of bamboos and timber for domestic purposes are permitted free and without restriction. The boundary descriptions and the rules for the management of these special unreserves will be found in the Forest Supplements of the *East Godavari District Gazette*, dated 22nd April 1929 and 21st November 1928, respectively.

SECTION 2.—PAST SYSTEMS OF MANAGEMENT AND THEIR RESULTS.

110. *General remarks.*—It is convenient, in describing the past systems of management and their results, to deal with each of the following groups separately :—

A. The reserved forests of Peddapur and Gokavaram ranges, including the two Devancheruvu blocks of Rajahmundry range.
B. The coastal reserves of Rajahmundry range.
C. The reserved forests of Polavaram range.

A. The reserved forests of Peddapur and Gokavaram ranges including the two Devancheruvu blocks.

111. *Management immediately after reservation.*—Nearly all the reserved forests of Peddapur and Gokavaram ranges were constituted between the years 1891 and 1896. The four reserves that were notified after this date are Singampalli, in 1897; Doramamidi

Extension, in 1899 ; and Rajavomangi and Ultimathula, in 1900. The permit system was applied to each reserved forest as it was constituted, and this system remained in force over the greater part of the present Peddapur and Gokavaram ranges until 1906. Naturally it led to over-felling of the valuable species in all the accessible forests. When this was noticed, the issue of permits for the better species was stopped by the District Forest Officer ; but owing to the extensive area covered by the range—all these reserves then formed one range—and the shortage of executive staff, organized working could not be introduced until several years later.

112. *Introduction of working plans.*—

(1) The first working plan to be introduced in the area covered by the present Lower Godavari division was Mr. Hugo Wood's plan, of 1899, for improving the growth in Mallavaram reserve. All timber of large dimensions had been removed from this reserve under the permit system, and the working plan aimed at re-establishing the forest. The hill tops and slopes were preserved for the production of small timber and poles, and the rest of the reserve was divided into 25 compartments to be worked as coppice-with-standards. All tamarind, soap-nut, and wood-apple trees were to be retained in the felled compartments, in addition to 25 standards per acre. The permit system did not cease with the introduction of this working plan, but continued in force, in a modified form, until 1906, the removal of produce on permits being confined to the coupe of the year. Departmental working was introduced in 1907 and the fuel and other produce were sent to the Government depot at Cocanada. From 1908 to 1911 the produce obtained from the departmental fellings was sold to the contractors at the coupes ; and in 1912 the lease system was introduced.

(2) In 1899 a similar working plan was drawn up for the two Devancheruvu blocks, each block being divided into 25 coupes. But regular working, on the lines prescribed in the plan, was not introduced until 1907 when departmental operations were undertaken, and the fuel was sent to the Government depot at Rajahmundry. From 1912 onwards the Devancheruvu blocks were leased to contractors.

113. *The Annavaram goat browsing plan*—1904.—In 1904, the District Forest Officer, Mr. Hugo Wood, drew up a working plan for goat browsing in Annavaram reserve to provide browsing for 2,000 goats at one acre per goat per annum on a rotational scheme. The reserve was divided into four *parcelles* of about 2,000 acres each. Each *parcelle* was to be open to browsing for four years and then closed for twelve years. The fee was to be 3 annas per goat per annum. This plan does not appear to have been submitted to the Board of Revenue for sanction ; apparently it was given a trial and then abandoned.

114. *The first working plan for Sudikonda and Tirumalayapalem reserves.*—In 1905, a working plan for Sudikonda and Tirumalayapalem reserves was drawn up by the District Forest Officer, Mr. Foulkes, on the same lines as the Mallavaram plan of 1899 ; and, although there is no record of its having been sanctioned by the Board of Revenue, it was brought into force the following year. The flat and gently sloping ground in Sudikonda reserve, estimated at 2,682 acres, formed one felling series, and 3,330 acres of easy ground in Tirumalayapalem reserve formed two felling series. The silvicultural system was coppice-with-standards on a rotation of 25 years. Felled copues were closed to grazing for five years. The plan remained in force until 1912 when it was modified by the Conservator, Mr. A. W. Lushington.

115. *The revised working plans for Sudikonda, Tirumalayapalem, Mallavaram and Devancheruvu reserves*—1913.—In 1912, the Conservator, Mr. A. W. Lushington, inspected these reserves and decided that changes were necessary in the method of working. In the Devancheruvu reserves simple coppice was introduced in place of coppice-with-standards, the rotation was reduced to 21 years, and the period of closure to grazing was increased to eight years. A part of Molleru reserve was added to the Sudikonda—Tirumalayapalem—Mallavaram group, and these four reserves were divided into five blocks: Mallavaram reserve forming two blocks, and the other reserves one block each. Each block was divided into three coupes making 15 coupes in all. Simple coppice was introduced and the rotation was reduced to 15 years. The idea was to concentrate fellings in one locality, consequently there was only one series of large coupes in the group of five blocks. Coupes were allotted to different blocks each year so that part of each block was felled once in five years. The hill slopes of these four reserves were divided into six blocks—Sudikonda and Molleru reserves forming two blocks each. These six blocks formed a Selection Working Circle to be worked for small timber. The Devancheruvu coupes worked more or less satisfactorily until the working plan was revised in 1919. The fuel coupes in the Sudikonda group were found to be too large, and there was no demand for fuel from the Molleru block. For these and other reasons the working plan was revised in 1919. The selection fellings failed for want of demand.

116. *Mr. Seager's working plan for the Sudikonda, Tirumalayapalem, Mallavaram and Devancheruvu reserves*—1919.—In 1919, the working plan for these reserves was revised by Mr. Seager, the District Forest Officer. The coupes in the Sudikonda group had been found to be too large, and there had been no demand for the coupes in the Molleru reserve. It was also found necessary to raise the rotation to supply the market with small timber as well as fuel. The Melleru reserve was closed to fuel working, and the remaining four reserves were divided into seven felling series as follows :—

Reserve.	Estimated workable area.	Number of felling series.
	ACS.	
Sudikonda	2,682	2
Tirumalayapalem ..	3,330	2
Mallavaram	6,000	3
Total area ..	12,012	7

The rotation was fixed at 30 years. All felled coupes were closed to grazing and bamboo working for five years after felling. The hill slopes above the working circle limits were closed to grazing. In the Devancheruvu reserves the rotation was raised to 25 years. The prescriptions for bamboo working will be referred to in a separate paragraph. This working plan is still in force. The plan for the two Devancheruvu blocks is working satisfactorily and no change is necessary ; but three felling series are too many for the Mallavaram reserve, and the coupes in the Sudikonda, Tirumalayapalem and Mallavaram reserves need rearranging to exclude the dense bamboo forests.

117. *The first working plan for the Peddapur range.*—In 1906, Mr. Foulkes, the District Forest Officer, prepared the first working plan for the Peddapur range, which was sanctioned in B.P. Forests No. 243, dated 19th November 1906. This plan prescribed the abolition of the permit system ; an increase in the executive staff ; opening out the range by constructing roads and buildings ; and extension of fire protection. Fuel fellings were confined to parts of the Lingamparti reserve, and limited to 700 cart loads of fuel per annum for the first three years. It was thought that the opening out of the country by constructing roads would result in an increased demand which would be met by working other accessible reserves. The prescriptions for bamboo working will be referred to in a separate paragraph. Timber poles were to be extracted departmentally from the areas that were worked for bamboo. The quantity of timber to be extracted annually was to be limited to 850 cartloads at 20 poles per cart load, for the first three years. Thereafter it was expected that both the demand and the outturn would increase. This plan failed to work, chiefly for want of markets.

118. *Mr. Latham's working scheme*—1917.—In 1917, the Conservator, Mr. Latham, drew up a scheme for working the Lakkonda amd Molleru reserves of Gokavaram range, and the Peddagarangi, Lingamparti, Annavaram, Raghavapatnam and Anantaram reserves of Peddapur range for fuel and timber. The areas to be worked for fuel were to be situated on the flat ground that skirts the hill slopes of these reserves, and on the lower slopes up to about 100 feet above the flat ground, in blocks of not less than 150 acres. The rotation was fixed at 30 years, and the area of the coupes was to be about 50 acres. The coupes were not allotted to particular years but were to be felled whenever they were saleable. The slopes were to be worked for timber on selection lines with a girth limit of 4 feet. The scheme limped along for a few years. In Lakkonda reserve five coupes were sold but the area actually felled each year varied from nil to 2½ acres. In Lingamparti reserve, coupe I was sold in 1921–22, and two more coupes were sold between 1922 and 1931, but they were only partially felled. In Annavaram reserve, two coupes were sold between 1919 and 1926, and there have been no fellings since that date. In Anantaram reserve, coupe I was sold in 1927–28 but the contractor felled only one acre. There were no other fellings in the fuel coupes, and no selection felling of timber. Mr. Latham's scheme failed because there was no local demand for fuel, and the areas selected for felling were too remote to be tapped for the Rajahmundry and Cocanada markets.

119. *Bamboo working.*—Prior to 1906 the bamboo forests were worked on the permit system throughout the present Peddapur and Gokavaram ranges. In 1906, the Conservator, Mr. A. W. Lushington, is reported to have introduced departmental working of bamboos in parts of Gokavaram range, but there are no records to show how these fellings were carried out. In the same year Mr. Foulke's working plan for the Peddapur range was sanctioned. It prescribed a bamboo working circle containing two cutting series : No. 1, comprising Lingamparti and Annavaram reserves, and No. 2 comprising Jaddangi and Virabhadrapuram reserves. The working plan records that "the bamboos in the readily accessible areas have been much overcut and the clumps left in a very untidy and irregular

state. The majority of the clumps have only 10 to 25 culms left in them." No felling cycle was fixed but the quantity of bamboos to be removed per annum from the working circle was restricted to a million "small bamboos" and, two hundred thousand 'large bamboos.' The clumps were to be clearfelled, but two clumps in every five were to be left uncut; and the felling was to be done departmentally. There is nothing on record to show how these rules worked. In 1912, the Conservator, Mr. Lushington, divided the hill slopes of Sudikonda, Tirumalayapalem, Mallavaram and Molleru reserves into six bamboo blocks: one block was worked each year. Under Mr. Latham's working scheme of 1917 the bamboo forests were worked on a 3-year rotation in 5 felling series, namely :—

(1) Raghavapatnam and Anantaram reserves,
(2) Lingamparti and Peddagarangi reserves,
(3) & (4) Annavaram reserve, and
(5) Aminbada and Jaddangi reserves.

This felling scheme continued in force until 1921. In 1918, *Dendrocalamus strictus* flowered gregariously, consequently, from 1922 to 1925, all the reserved forests of these two ranges, except Sudikonda, Tirumalayapalem and Mallavaram which contain very little *Dendrocalamus*, were sold annually to obtain as much revenue as possible from the dead bamboos and to reduce the fire hazard. According to Mr. Seager's working plan of 1918, the Sudikonda, Tirumalayapalem and Mallavaram reserves were formed into one bamboo working circle. The felling cycle was three years, and one reserve was worked each year. This plan remained in force until 1925 when a revised working plan for the bamboo forests of the Lower Godavari division was drawn up, and sanctioned by the Chief Conservator in his Proceedings No. L. Dis. 3084 of 1926, dated 17th May 1926. The forests of the Peddapur and Gokavaram ranges were divided into 7 felling series to be worked on a cycle of 4 years. The culms were not to be cut higher than 1 to 2 feet above ground level; and a minimum of 6 culms were to be retained in a large clump, and 4 culms in a small clump. This working plan is still in force; but the felling rules have generally been disregarded due to the difficulty of supervision and control.

B. The Coastal reserves of Rajahmundry range.

120. *Composition.*—The coastal forests of Rajahmundry range include Coringa, Coringa Extension, Kandikuppa and Upputeru reserves. Each reserve will be dealt with separately.

121. *Management of Coringa reserve immediately after reservation.*—The Coringa reserve was constituted in the year 1888. The mangrove forests of this reserve had been subjected to irregular working on the permit system for several years before reservation, permits for fuel being issued at 6 annas per cartload and 3 pies per kavidyload; and all the easily accessible areas had been overfelled for the supply of fuel to Cocanada town. Immediately after reservation all felling was stopped, and it was prescribed that the forests should be given rest for 5 years.

122. *Mr. Peet's felling scheme of* 1893.—In 1893 fellings were resumed on a scheme drawn up by the Conservator, Mr. Peet. The reserve was divided into 12 compartments, and worked as coppice-with-standards on a rotation of 12 years, about 20 standards per acre, being reserved. This scheme remained in force until 1902. One compartment was worked on the permit system, but the entire crop in the remaining compartments was sold standing to contractors.

123. *Mr. Hugo Wood's working plan*—1902.—In 1912 the Conservator, Mr. Brasier, inspected the Coringa reserve. He noticed the rings in the wood of the Avicennias, the principal species in this reserve, and, believing that they were annual rings, he came to the conclusion that the rotation of 12 years was too short to produce fuel 5 to 6 inches in diameter—the sizes required by the mills and the railway; and, from ring countings on old stumps, he concluded that it would take 40 years to attain a diameter of from 5 to 6 inches. He therefore ordered that the rotation should be increased to 40 years, and that the 12 compartments were to be divided into 40 more or less equi-productive coupes. In order to determine the most suitable treatment for mangrove forests, he ordered that a half of each coupe was to be worked as coppice-with-standards, retaining 40 standards per acre, and that the other half was to be worked on "a modification of the high forest system" by removing the crop in three successive annual fellings. A working plan on these lines was prepared by Mr. Hugo Wood, the District Forest Officer, and sanctioned in B.P. (Forest) No. 220, dated 30th July 1902. The objects of management were declared to be—

"(*a*) To determine the best method of treatment suitable for the proper reproduction of the more important species.
(*b*) To protect and increase the more valuable species of Mada.
(*c*) To provide a maximum sustained yield of fuel, a certain percentage of which would be fit for steam engines.
(*d*) To provide grazing for the cattle of the neighbouring villages with as little injury to the crop as possible."

The rotation was fixed at 40 years. In order to ensure proper coppicing in the half of each coupe to be worked as coppice-with-standards, the trees were to be felled departmentally under supervision, all trees being felled flush with the ground. The billeting and extraction were to be done on contract. The successive annual fellings in the other half of each coupe were to be conducted by the Range Officer according to the following rules : wherever seedlings were in abundance under and between the larger trees one tree in three was to be cut ; and where the crowns of the large trees were close together but there were no seedlings on the ground the cover was to be opened out to encourage natural regeneration. When this working plan was prepared it was not known that the Avicennias of the Coringa reserves do not coppice, and that the rings in the wood of the Avicennias are not annual rings. The Coringa reserve was worked on Mr. Hugo Wood's plan until 1912 when the prescriptions were revised by Mr. A. W. Lushington.

124. *Mr. Lushington's working plan*—1912.—In his inspections of the Coringa reserve, the Conservator, Mr. A. W. Lushington, noticed that the rings in the wood of the Avicennia, were not continuous and concentric, and so he concluded that they were not annual rings. He estimated that it took 15 years to attain a diameter of 5 inches ; and he found that the bulk of the yield from the Coringa coupes was utilized for domestic fuel, for which purpose a diameter of 1½ to 3 inches was most suitable, whereas the quantity of large billets supplied to the mills and the railway was of small account. He therefore decided that the Coringa reserve should be worked for the supply of domestic fuel, and the rotation was reduced to 8 years, the 40 coupes of Mr. Hugo Wood's plan being divided into 5 felling series of 8 coupes each. Another reason advanced by Mr. Lushington for reducing the rotation was that swamp species would not live for 40 years owing to the deposits of silt raising the ground above tidal influence. Although Mr. Lushington noticed that the bulk of the regeneration was obtained from seed and not from coppice, the silvicultural system continued to be coppice-with-standards. The revised plan remained in force until 1919 when it was found necessary to change the silvicultural system and raise the rotation.

125. *Mr. Latham's working plan*—1918.—The working plan for Coringa reserve was revised once again in 1918. At the suggestion of the Conservator, Mr. Latham, the rotation was raised to 10 years, the 40 coupes of Mr. Hugo Wood's plan being redistributed once again into 4 felling series of 10 coupes each. The silvicultural system adopted was clear-felling, although in the working plan it was described as simple coppice. The revision was tentatively sanctioned in B.F. No. 161, Miscellaneous, dated 1st May 1918.

126. *Ranger Appa Rao Nayudu's working plan*—1923.—In 1921, the Conservator, Mr. Scot, made a careful inspection of the Coringa reserves, and wrote a very interesting inspection note on the mangrove forests. By this time it was known that the Avicennias of Coringa reserve could not be regenerated by coppice ; and the past estimates of the rate of growth were found to be defective. Meanwhile, the Coringa Extension reserve had been constituted, and, under the direction of the Conservator, a revised working plan to include both reserves was prepared in 1922 by Ranger Appa Rao Nayudu. This plan was sanctioned for five years in Chief Conservator's Proceedings Mis. No. 35, dated 24th January 1923, and it was extended for another five years in Chief Conservator's Proceedings Rout. No. 182, dated 23rd May 1928. The working plan is still in force. The two reserves form one working circle, the silvicultural system being clear-felling with natural regeneration supplemented by coppice from the auxiliary species. There are four felling series : A and B to the west of the Gaderu comprising the whole of Coringa reserve and part of Coringa Extension reserve ; and C and D to the east of the Gaderu comprising Hope Island and the rest of Coringa Extension reserve. The rotation for series C and D was fixed at 25 years ; and, as the rate of growth in series A and B was believed to be somewhat faster than in the other two series, the rotation for series A and B was fixed at 20 years. The coupes in series A and B are closed to grazing for five years after felling, while series C and D are permanently closed to grazing. Owing to the shortage of labour available for work in the mangrove swamps large areas have been left unfelled in the annual coupes ; and the permanent closure to grazing of felling series C and D has long been a dead letter.

127. *Management of the Coringa Extension reserve.*—Coringa reserve, which includes Hope Island, was notified for reservation under the Madras Forest Act in 1901, but it was not declared to be a reserved forest until 1921. Prior to 1874 Hope Island had been worked for fuel for the launches and dredgers belonging to the Marine department. In 1874 Government ordered the conservancy of Hope Island for the use of the Marine department subject to the payment of light seigniorage fees for the fuel removed from the Island. Later the seigniorage fees were compounded for an annual payment of Rs. 100. In 1886 the District Forest Officer proposed that Hope Island should be managed by the Forest department, but the proposal was turned down by Government. In 1918 the District Forest Officer reported that the management of the mangrove forests on Hope Island was

unsystematic and wasteful, and he suggested that the Island should be transferred to the control of the Forest department. The proposal was supported by the Collector and sanctioned by Government subject to certain conditions regarding the supply of fuel to the Port Conservancy Board, Cocanada. A note on the supply of fuel to the Port Conservancy Board, Cocanada, by the Forest department will be found in Appendix VI of this working plan. In 1918, as soon as the management of Hope Island was transferred to the Forest department, a working scheme was drawn up for the forests to be included in the proposed Coringa Extension reserve. The entire area, excluding Hope Island, was divided into four felling series to be worked as simple coppice on a rotation of 15 years. The reason ascribed for adopting a longer rotation for these forests than in the adjoining Coringa reserve was that Tella mada, the principal species, grows somewhat slower than Nalla mada which forms the bulk of the crop in Coringa reserve. But, although Hope Island is stocked chiefly with Tella mada, as the growth was found to be exceptionally good, it was worked as simple coppice on a rotation of 10 years. This scheme remained in force until 1923—two years after the Coringa Extension reserve was established. No information is available in regard to the areas worked under this scheme outside Hope Island, but during the five years that this scheme was in force, an aggregate area of 2,442 acres were felled on Hope Island. In 1923, the forests of Coringa Extension situated west of the Gaderu were divided into two felling series—series C and D of Ranger Appa Rao Nayudu's working plan—and worked as simple coppice on a rotation of 25 years. This plan is still in force.

128. *Facts influencing the management of Kandikuppa reserve.*—The Kandikuppa reserve was constituted in 1898. The inhabitants of the fishing villages situated within and adjoining the reserve appear to have received little consideration at the settlement, for even fishing was not admitted as a right. But, although the reserve is legally free of all encumbrances, the habits and wants of the fisherfolk have greatly influenced the management of these forests. The following four villages are dependent on the Kandikuppa reserve for their supplies of fuel which they have always obtained from these mangrove swamps :—

(*a*) Pandi-pallam—a large fishing village situated within the reserve, containing about 800 families, with a population of about 3,000.

(*b*) Pora—a small fishing village situated within the reserve, about two miles to the north-east of Pandi-pallam, containing about 150 families with a total population of about 600.

(*c*) Molletimoga—a fishing village containing about 100 families and a population of about 400, situated alongside the northern boundary of the reserve.

(*d*) Neelarevu—a village alongside the southern boundary of the reserve, the inhabitants of which live chiefly by collecting sea shells for the manufacture of lime. The population is about the same as that of Molletimoga.

Prior to the formation of the Kandikuppa reserve, the inhabitants of these four villages appear to have had free access to the mangrove swamps, for the collection of fuel. No rights to fuel were admitted at settlement, but it was soon found necessary to provide for the local demand; and in 1898, the year that the reserve was constituted, the Collector authorized the Forest department to charge the local fishermen 6 annas per family per *mensem* for the removal of dry fuel for domestic purposes and smoking fish.

129. *Management of Kandikuppa reserve from* 1898 *to* 1900.—No regular working was in force during the first three years after reservation, but the removal of dry wood was permitted, to meet the demand of the fishing villages. As the fisherfolk were in the habit of collecting fuel while fishing in the creeks of Kandikuppa reserve, it was first proposed that licences should be issued for fishing; but the proposal was turned down, and it was ordered that the fishermen were to take out fuel permits at the rate of 6 annas per family per mensem, and that the possession of such permits would entitle them to fish in the reserve. In order to enforce this rule people fishing within the creeks of Kandikuppa reserve were required to produce their fuel permits. This naturally created the impression amongst the fisherfolk that fishing was being taxed. In 1898, the year of reservation, the revenue from fuel fees was Rs. 88, and in the following year the collection increased to Rs. 578. In 1900 the collection of fuel fees was stopped preparatory to introducing a working plan for the Kandikuppa mangrove forests, but both fishing and the removal of dry wood appear to have been permitted during this year.

130. *Mr. Hugo Wood's working plan for the Kandikuppa mangrove forests*—1900.—In 1900, the District Forest Officer, Mr. Hugo Wood, prepared a working plan for the mangrove forests of Kandikuppa reserve, which was sanctioned in B.P. No. 224, dated 1st June 1900, and brought into force the following year. Mr. Hugo Wood drew attention to the deficiency of fuel in the fishing villages, and pointed out that all the fuel that the forest could produce would be needed for local consumption. He disapproved of the existing system of issuing permits for dry fuel on family units, and concluded that fishing should

be free, and that "a succession of annual coupes should be opened which would be sold by auction to a local contractor who would supply the fisherfolk with fuel at certain prescribed rates." The mangrove forests were divided into two compartments designated A and B, each containing a felling series of ten coupes to be worked as simple coppice on a rotation of 10 years. It was emphasised that theft would have to be suppressed with severity if the forests were to be improved. Experience has shown that the management prescribed by Mr. Hugo Wood was eminently sound and just what was needed at the time. But, although the working plan continued in force until 1923, there appear to have been repeated departures from its main principles in the face of opposition from the fishermen. In 1909 the collection of fees for unregulated removals of fuel was resumed, but it was stopped a year later by Mr. Dawson, the District Forest Officer, on account of the reckless hacking of green fuel. In 1912 the collection of fuel fees was again resumed but the fee was reduced to 6 annas per family per *annum*, and the collection does not appear to have been rigorously enforced. Meanwhile, the fuel coupes were worked for the supply of fuel to Cocanada and Yenam, in direct opposition to the main purpose of the working plan.

131. *Mr. Seager's rules for the removal of fuel by fishermen*—1913.—In 1913, Mr. Seager, the District Forest Officer, made an attempt to regularise the removal of fuel by fishermen; and the following rules were passed by the Collector and published in the District Gazette :—

> "(1) A fee of 4 annas per mensem should be paid by every family fishing in the Kandikuppa and Coringa reserves towards the value of fuel removed by them for their domestic consumption and fish curing, the amount being payable in advance for every four months, i.e., Re. 1 at a time.
>
> (2) The payment of the above fees authorizes the members of the family concerned to remove dry fuel or, if it is not available, green branches of trees, not exceeding 3 inches in girth, for the above purposes only.
>
> (3) The removal in each case should not exceed one head-load at a time."

There were four other rules dealing with the issue, production and cancellation of permits. These rules remained in force in Kandikuppa reserve until 1924 when part of the reserve was handed over to panchayat management and the removal of fuel for domestic consumption was restricted to the panchayat areas. There appears to have been considerable laxity in applying Mr. Seager's rules. The term 'family' was never defined, and being an indefinite unit large numbers were grouped together in one family. The average number of families for which fuel fees were paid was only 144; whereas, according to figures which have recently been produced to support the demand for fuel, and which are endorsed by the District Labour Officer, there are about 1,000 families in the four villages, and the total population exceeds 4,000. In 1900 Mr. Hugo Wood had pointed out the unsuitability of the family as a unit for the collection of fuel fees and it is surprising that no limit was placed on the number to be included in a family under Mr. Seager's rules.

132. *The lease of parts of Kandikuppa reserve for management by panchayats, and the revised working plan*—1923.—Mr. Seager's rule permitting the fishermen to fell green fuel up to 3 inches in girth led to reckless felling throughout the reserve and something had to be done to stop the damage. In 1923, it was proposed by the acting Conservator, Mr. Longrigg, to hand over 2,252 acres to panchayat management and to restrict the fishermen to this area. The rest of the reserve, excluding certain unproductive blanks, was to be formed into a Mangrove Felling Series with an area of 3,412 acres, and worked as simple coppice on a rotation of 25 years. This felling series was to be strictly closed to grazing and unregulated fellings. The area to be handed over to panchayat management was distributed as follows :—

Name of village. (1)	Approximate population. (2)	Area leased. (3)	Annual lease fee. (4)
		ACS.	RS.
Neelarevu	400	337	200
Pandi-pallam	2,270	1,390	400
Pora	570	200	120
Molletimoga	370	325	150
Total ..	3,610	2,252	870

This scheme was sanctioned in Chief Conservator's Proceedings No. 459, dated 28th August 1923. As the areas handed over to panchayat management adjoined the four villages, they had for a long time been subjected to illicit fellings and were very much poorer than the areas reserved for departmental management; and it must have been apparent at the time that they were incapable of meeting the local demand for more than a few years. Before this scheme received the Chief Conservator's approval it was referred to Mr. Bennett, Conservator, I Circle, for remarks, and in approving the scheme he wrote as follows : "The tree growth on the parts leased to the villages will doubtless disappear in the course of a few years, and if the villagers then intend to steal fuel they will have to thieve from further away from their villages. Their theft would then be easier to check. Having relieved the present situation by the leasing of forests to the four villages, we shall, when the growth on the leased forest has been destroyed, be in a position to require the fishermen to buy their fuel from a depot in our felling series coupe at reasonable rates." So it is obvious that the panchayat arrangement was merely a temporary expedient to tide over a difficulty ; and in shelving the main issues it has made it more difficult to deal with them at a later date. The panchayat leases were executed for five years in the first instance, and they were renewed for another period of five years in 1919. Meanwhile the fuel from the Mangrove Felling Series has been exported to Cocanada and elsewhere, while the panchayat forests, being insufficient to meet the local demand, have been more or less denuded, and the fishermen being unable to obtain their requirements of fuel from the leased areas are resorting to theft. The residents of Molletimoga and Neelarevu profess to be satisfied with the present arrangement : the former supplement their supplies of fuel from the Balasatippa Zamindari forests, while the latter pick up fuel washed up on the beach. But the fishermen of Pandi-pallam and Pora have, in recent years, made several complaints about shortage of fuel. This matter was investigated ; and in G.O. Ms. No. 1120, Development, dated 29th July 1931, the Government accepted the Chief Conservator's recommendation to set apart a separate area for the use of the fishermen constituting this a special felling series to be worked on a rotation of 25 years. One coupe would be available for the fishermen every year on payment of Rs. 23 per acre—the average price obtained for the coupes of the Mangrove Felling Series during the previous three years. This scheme proved abortive because the fishermen refused to pay more than Rs. 10 per acre. Thereafter alternative proposals were submitted by the Conservator and the Collector the details of which will be found in the District Forest office file No. A-767 of 1932. It was finally decided that the matter should be dealt with in preparing this working plan. In 1900 Mr. Hugo Wood drew attention to the fact that all the fuel that the forest could produce would be required for local consumption ; and in 1922 Ranger Appa Rao Nayudu, in preparing a revised working scheme, estimated that the quantity of fuel removed by irregular felling was over 105,000 cubic feet per annum against a mean average yield of 60,552 cubic feet from the annual coupes. It still remains a fact that—

(a) the entire local demand is obtained from the Kandikuppa reserve ;

(b) the yield from the Kandikuppa mangrove forests is barely sufficient to meet the local demand ;

(c) the local demand is a demand of necessity, the fishermen being unable to obtain their requirements elsewhere at a reasonable cost.

Consequently all felling for outside markets is overfelling.

133. *The Kandikuppa Casuarina Plantation*, 1899—1919.—In 1899 a long narrow strip of sand along the seaboard of Kandikuppa reserve with an area of 570 acres was selected by the District Forest Officer, Mr. Hugo Wood, for planting casuarina. It was then a treeless sandy waste used chiefly for grazing. The object of the plantation was to grow long straight poles to be supplied to the Public Works Department for river protection works. The demand for such poles was then far greater than the supplies available in the district. The fuel obtained from thinnings and branchwood was to be utilized either for local supply or for supplying the fuel markets at Cocanada and Samalkot. To meet the objects of management it was considered necessary to adopt a longer rotation than for fuel crops, and to reduce the planting espacement ; consequently the area was divided into 15 compartments to be planted 6′ × 6′ on a rotation of 15 years. A working plan for the casuarina plantation was prepared by the District Forest Officer, and sanctioned in B.P. Forest No. 254, dated 15th June 1899. Meanwhile a nursery had been established, and planting commenced the same year. The estimates for watering and other labour charges in this estimate were found to be defective, and a revised working plan was prepared by Mr. Hugo Wood in 1902 after three compartments with an aggregate area of 114 acres had been planted. The revised working plan was sanctioned in B.P. Forest No. 221, dated 30th July 1902. The rotation continued to be 15 years, and the planting espacement 6′ × 6′ ; while the area to be planted each year remained the same, namely 38 acres. The cost of labour was raised to Rs. 5 per mensem. The plantation was to be watered as follows :—

First year—

Two months—daily watering.

Three months—watering every alternate day.

Three months—watering every third day.

Second year—
Six months—watering every third day.

Third year—
Four months—watering every third day.

The cost of formation was estimated at Rs. 82–10–4 per acre as follows :—

	RS.	A.	P.	
(1) Nursery work and planting	4	5	4	per acre.
(2) Watering, first year	45	0	0	,,
(3) Watering, second year	20	0	0	,,
(4) Watering, third year	13	5	4	,,
Total cost	82	10	4	,,

The plantations were to be thinned lightly in the sixth year removing only dead and suppressed trees, estimated to average about 150 per acre. A second thinning was to be carried out in the tenth year removing one-third of the crop averaging about 350 per acre. This thinning was estimated to yield 10 tons per acre. A third thinning was to be carried out in the thirteenth year removing about 300 trees leaving 400 trees for the final crop. The third thinning was estimated to yield 15 tons per acre, and the final crop 40 tons per acre. The plantation was expected to produce a net revenue of Rs. 4,542 per annum. Unfortunately no figures are available to show what yields were obtained from the 14 compartments that were planted and felled under the working plan. The plantation was found to be unprofitable, due probably to the heavy cost of formation and an over-estimate of the yield. In 1913 all casuarina planting by the Forest department was stopped in accordance with B.P. Forest No. 37, dated 13th February 1913, which ordered that the planting of casuarina should in future be left to private enterprise, and that the existing plantations were to be disafforested and sold. Later the Board of Revenue accepted the recommendation of the Collector that, as the greater part of the growing stock in the Kandikuppa plantation was immature ranging in age from 1 to 14 years, the crop should be sold at two compartments each year—vide B.P. Forest No. 158, dated 2nd August 1913. Nine compartments were sold under these orders. Meanwhile the District Forest Officer pointed out that the Kandikuppa casuarina plantation was situated within the limits of the Kandikuppa reserve and he proposed that the land should be retained and not disafforested. This was sanctioned in B.P. Forest No. 124, dated 15th February 1919.

134. *The Kandikuppa casuarina plantation*, 1923–33.—In 1923 an experimental plot of 5 acres was planted departmentally, and 15 acres were planted on contract, in order to ascertain whether casuarina could be raised at a reasonable cost. The experiment proved successful and regular planting was commenced in 1924 on a working scheme which was sanctioned by the Conservator. A planting espacement of 7′ × 7′ was adopted, and the rotation was fixed at 10 years. The lower branches are pruned in the fourth year, and a mechanical thinning removing alternate diagonal rows, is made in the sixth year leaving the final crop with an espacement of 10′ × 10′. The scheme is working successfully and the first plantation will be felled in 1934.

135. *The Upputeru reserves.*—The Upputeru reserve, comprising two blocks, was constituted in 1896. The area of block I was estimated at 3,324 acres, and the area of block II at 11,614 acres. For many years before reservation, and until 1893 block II was worked on the permit system without any restriction, the rate charged for fuel being Re. 1–4–0 per ton of 100 cubic feet. In 1893 the block was reported to be overfelled and was closed to all cutting. In 1894 it was again opened but the annual yield was limited to 800 tons at Re. 1–4–0 per ton. In 1895 the seigniorage rate was raised to Rs. 2–8–0 on the grounds that the fuel from this block being cheap was underselling fuel obtained from the Kistna forests on the Masulipatam market. This indicates that there must have been heavy felling in block II : it is recorded that 740 tons were removed between June and August 1895. In order to restrict the felling, a simple working scheme was drawn up in 1895 by Mr. A. B. Jackson. Block II was divided into 4 compartments and block I formed a single compartment, making 5 compartments in all. Fellings were restricted to one compartment a year on a rotation of five years. The removal of fuel was permitted on the permit system, permits being obtained from a permit gumasta who was stationed at Mogalturru. The rates charged were Rs. 2–8–0 per ton for mada, thanduga, and gugillam ; and Re. 1–4–0 per ton for other species. As mada was not found in all parts of the two blocks, the compartments were arranged so as to distribute the mada as evenly as possible. The working scheme was sanctioned by the conservator. As this scheme had not been sanctioned by the Board of Revenue, a working plan on the same lines was

prepared in 1899 by Mr. Hugo Wood, the District Forest Officer, and sanctioned in B.P. Forest No. 422, dated 7th October 1899, for five years, ending 30th June 1904. The working plan was extended for another five years in B.P. Forest No. 144, dated 26th July 1904, in which provision was made for sowing 200 acres per annum, with seeds of mada and thanduga, at 10 annas per acre, and fencing the area sown each year at a cost of Rs. 50. There is nothing on record to show how this work was carried out and the results obtained. This working plan continued in force until 1916, when the rotation was increased to 10 years by dividing each compartment into two coupes. In 1918 a revised working plan for the two Upputeru blocks prepared by the District Forest Officer, Mr. E. B. Ramachandra Rao, was sanctioned in B.P. Forest No. 464, Mis., dated 18th October 1918. As the previous coupes had been found to be too large, each compartment was constituted a separate felling series and worked as simple coppice on a rotation of 10 years, but the fringe of mada growing along the creeks was retained for seed. This working plan remained in force until the end of June 1928. Meanwhile, in 1924, block I was handed over to panchayat management. In 1928 a revised working plan for Upputeru block II was prepared by the District Forest Officer, Mr. Abdul Qudir, and sanctioned in Chief Conservator's Proceedings Mis. No. 243, dated 16th July 1928. The object of management is to grow fuel to a size suitable both for domestic consumption and to meet the demand from the fuel factories at Penugonda and Palacole. It has been estimated that a girth of 12 inches is the most suitable size for this purpose, and that the corresponding age for a mixed coppice crop of thanduga and tella will be about 20 years. The rotation was raised to 20 years, and the working circle was divided into two felling series by the simple expedient of combining the felling series which had been worked on a rotation of 10 years under the previous working plan. Thus, the Modi and Bondada series, each with 10 coupes, were combined to form the Modi-Bondada Felling Series with 20 coupes; and the Dongapandi and Losari blocks were combined similarly to form the Dongapandi-Losari Felling Series. The silvicultural system is simple coppice. The working plan is still in force and the coupes are being worked according to plan. The old Madras 4-inch Survey, on which the working plan map is based, is very inaccurate in parts; and, as the blanks have not been surveyed, the wooded area has been over-estimated in the working plan. It is doubtful that the yield from the depleted growing stock is sufficient to meet the local demand as well as supply fuel to the factories at Palacole, Penugonda, and elsewhere. It will probably be found more satisfactory to work the forests solely for local consumption.

C. The reserved forests of Polavaram range.

136. *Past management of the timber and fuel forests.*—The six reserves that now form the Polavaram range were constituted between 1897 and 1899. For many years prior to reservation, the forests had been subjected to irregular fellings, and there is no doubt that a considerable quantity of teak was removed from the accessible areas during this period, and there appear to have been fairly extensive fellings even in the more inaccessible parts of Papikonda reserve and Kovvada block II. The permit system continued in force for 7 to 8 years after reservation: it was abolished in 1906. In 1899 Mr. Hooper, the Conservator, suggested constructing a timber slide on the slopes of Papikonda reserve. In 1903 the Conservator, Mr. Porter, proposed working the slopes of Paikonda reserve within reach of the Godavari as coppice-with-standards; and he recommended that the rest of Papikonda reserve should be worked on the selection system, with a girth limit, the yield being regulated by area. He also suggested that departmental planting should be tried in the teak forests, and also taungya. No information is available to show what work was carried out in accordance with Mr. Porter's proposals. In 1906 an attempt was made to work the lower slopes of Papikonda reserve for timber and fuel, but as the demand was irregular and the prices low, the work was abandoned after a few years. The subsequent working of the timber and fuel forests of this range is somewhat hazy. A series of fuel coupes were worked as simple coppice in Kopalli reserve until 1918 when Mr. Seager, the District Forest Officer, drew up a scheme for Marlagudem and parts of Kopalli reserve and Kovvada block I. In 1922 the District Forest Officer, Mr. Barry, drew up a scheme for working the teak forests of Beddadanole reserve; and the following year a scheme on the same lines was prepared by Mr. Van Haeften, Extra Assistant Conservator of Forests, for the Kopalli reserve. The work done under these three schemes will be described separately.

137. *Mr. Seager's scheme for Marlagudem and Kopalli reserves and Kovvada Block I—1918.*—In 1918 a tentative scheme for working the accessible parts of Polavaram range for fuel was drawn up by Mr. Seager, and sanctioned by the Conservator, Mr. Latham, in his R.O.C. No. 829 of 1918, dated 12th August 1918. A fuel working circle was formed comprising, Marlagudem reserve, and the flat ground at the southern end of Kopalli reserve

and Kovvada block I. The total area of the fuel working circle was 7,140 acres distributed as follows :—

	ACS.
Marlagudem reserve	2,100
Kopalli reserve	1,960
Kovvada block I	3,080
Total area ..	7,140

The first two reserves formed one felling series each, and there were two felling series in Kovvada block I. The silvicultural system was simple coppice and the rotation was 30 years. The coupes were closed to grazing and bamboo working for five years after felling. The felling series in Kopalli reserve and Kovvada block I were worked under this scheme for five years. As there was no local demand for fuel or timber other than teak, the coupes were purchased by contractors solely for the teak that they contained. They extracted all the teak and some selected timber of other species leaving the greater part of the coupe unworked ; and the prices realized were in direct relation to the quantity of teak available in the coupes. In 1923 the part of Mr. Seager's scheme relating to Kopalli and Kovvada reserves was cancelled by the Conservator, Mr. Bennett. The Marlagudem reserve was worked for a few years longer, but even this had eventually to be abandoned for want of demand.

138. *Mr. Barry's working scheme for the teak forests of Beddadanole reserve*—1922.—In 1922 the District Forest Officer, Mr. Barry, drew up a working scheme for the teak forests of Beddadanole reserve. It was revised in 1924, and sanctioned by the Conservator, Mr. Barry, in his R.O.C. No. 1746/23, dated 27th April 1924. The teak forests of Beddadanole reserve were formed into a teak felling series to be clear-felled on a rotation fixed arbitrarily at 36 years. Eleven coupes with an aggregate area of 608 acres were allotted for the period 1922–23 to 1932–33, and it was estimated that 1,300 acres would still be available for the remaining 25 years of the rotation. After felling, the slash was to be collected in small heaps, and burnt as evenly as possible in March. At first, it was expected that coppice and advance growth would provide the necessary regeneration, but later, teak seed was dibbled in the burnt patches. A climber cutting was to be carried out two years before a coupe was felled, and in the course of this operation all soft-wooded species with large crowns were to be girdled to induce natural regeneration of teak. Cleaning and climber cutting were to be carried out during the first four years after felling at the discretion of the District Forest Officer ; likewise thinnings. Felled coupes were to be closed to grazing for 5 years after felling. The scheme is still in force ; but in 1931 the regeneration arrangements were modified to provide for the artificial reproduction of teak on experimental lines. The original scheme makes inadequate provision for improving the composition of the crop, tending, and protection against fire ; and it is doubtful that the fellings have improved the quality of the crop.

139. *Mr. Van Haeften's scheme for the teak areas : of Kopalli reserve and Kovvada block I*—1923.—This scheme is very similar to Mr. Barry's scheme for Beddadanole reserve. It covers an area of 2,014 acres, of which 582 acres had been worked between 1912 and 1918, leaving 895 acres in Kopalli reserve and 537 acres in Kovvada block I to be worked under the new scheme. The rotation was fixed arbitrarily at 40 years. As climbers were found to be doing considerable damage in the old coupes it was prescribed that climber cutting was to be carried out at 200 acres per annum starting in April 1923. The scheme is working more or less according to plan.

140. *Bamboo working in Polavaram range.*—Before 1906 bamboos were worked on the permit system. In 1906, bamboo fellings were started on contract on a rotation of five years, but no information is available to show what areas were worked under this scheme. In 1918, Mr. Seager drew up a working scheme for the bamboo forests of Polavaram range along with his scheme for the fuel forests referred to in the previous paragraph. The bamboo forests were divided into the following three groups :—

	ACS.
Group I—Papikonda reserve and Kovvada block II	13,892
,, II—Kovvada block I	14,451
,, III—Kopalli reserve	14,860

Each group was divided into four more or less equal coupes to be worked on a rotation of four years. This bamboo working scheme is still in force. It has served its purpose, and being out of date it needs revision.

141. *Regulation of grazing.*—In the years immediately after forest reservation, no restrictions were imposed on grazing other than the payment of the prescribed grazing

fees. In course of time it was found necessary to close certain areas to grazing in the interests of the growing stock—chiefly to safeguard regeneration—and the area closed to grazing steadily increased; but at all times adequate grazing accommodation has been provided in the reserved forests. At present the following areas are closed to grazing :—

		ACS.
(1)	Felling Series C and D in Coringa Extension reserve	13,640
(2)	Kandikuppa Mangrove Felling Series	3,412
(3)	The hill slopes of Sudikonda, Mallavaram and Tirumalayapalem reserves	5,371
(4)	Felled coupes in Felling Series A and B in Coringa reserve ..	3,501
(5)	Felled coupes in Gokavaram range	2,092
(6)	Do. Peddapur range	241
(7)	Do. Devancheruvu blocks I and II	457
(8)	Do. Papikonda reserve	15
(9)	Do. Kopalli reserve and Kovvada block I	204
(10)	Do. Beddadanole reserve	324
(11)	Do. Marlagudem reserve	204
(12)	Do. Kandikuppa casuarina plantation	389
	Total area closed to grazing ..	29,850

Although felling series C and D in Coringa Extension reserve has been declared closed to grazing, the closure has not been enforced, and the total area closed to grazing is less than 6 per cent of the total area included in the working plan.

Originally, the unit for which grazing fees were levied was a grazing block. In G.O. Mis. No. 880, dated 17th June 1926, the range was fixed as the grazing unit; and according to G.O. Mis. No. 802, dated 11th June 1932, graziers now have the option of grazing over the whole district on payment of the highest rate in the district. In practice, grazing is generally confined to the reserves within easy reach of the villages and " alien " cattle seldom graze in more than one range.

The fees charged for grazing differ in different parts of the district. The following is the scale of fees in force in 1932 :—

(*a*) Cattle belonging to Koyas and Reddies resident in the Agency are permitted to graze free to the limit marked in the Karnam's census register.

(*b*) The permanent settlers in the Yellavaram division of the Agency are charged only 1 anna per cow or buffalo. This rate was fixed in 1925 presumably to encourage settlement in the Yellavaram division.

(*c*) The ordinary rate for local cattle throughout the division is 3 annas per cow-unit. The rate was fixed in 1895.

(*d*) Cattle driven up from the delta or elsewhere into the forests of the Uplands and the Agency are classed as alien cattle and are charged enhanced fees, namely: 6 annas per cow, 12 annas per buffalo and 1½ annas per sheep. This rate was fixed in 1924.

The following statement shows the intensity of grazing under each of the four categories referred to above, and the grazing revenue during the past ten years :—

Category.	Details.	Year.										Average for nine years. *
		1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	1930–31.	1931–32.	1932–33.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Free grazing ..	Buffaloes ..	905	947	1,069	811	873	834	788	645	716	740	825
	Cows	9,624	6,913	11,065	6,666	10,178	10,534	10,145	10,487	10,847	10,985	9,758
	Sheep	Nil.	Nil.	28	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	3
	Fees (Rupees).	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.
Settlers rates ..	Buffaloes ..	1,779	649	650	476	532	545	512	459	473	544	538
	Cows	26,444	14,532	15,812	15,078	13,601	14,806	14,765	15,783	13,455	14,313	14,683
	Sheep	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil
	Fees (Rupees).	2,808	919	1,029	972	863	959	955	1,015	870	929	945
Ordinary rates ..	Buffaloes ..	8,204	2,720	3,099	2,708	728	568	382	295	332	290	1,236
	Cows	6,503	14,746	16,320	12,774	2,938	8,329	7,172	7,405	6,718	5,474	9,097
	Sheep	Nil.	864	581	626	5,603	691	699	Nil	592	Nil.	1,073
	Fees (Rupees).	5,727	3,866	4,277	3,469	1,349	1,839	1,553	1,499	1,440	1,135	2,260
Enhanced rates.	Buffaloes ..	1,347	9,415	7,716	7,271	8,007	7,796	6,831	7,352	7,114	11,609	8,090
	Cows	590	11,518	9,707	7,087	5,749	4,627	4,224	3,884	4,459	7,646	6,545
	Sheep	Nil.	2,909	6,698	790	Nil.	Nil.	85	68	89	80	1,191
	Fees (Rupees)..	1,232	9,031	10,682	8,260	8,154	7,582	6,725	6,983	7,024	11,589	8,448
All classes ..	Buffaloes ..	12,235	13,731	12,534	11,266	10,140	9,743	8,513	8,751	8,636	13,183	10,722
	Cows	43,161	47,709	52,904	41,605	32,466	38,356	36,306	37,559	35,479	38,418	40,089
	Sheep	Nil.	3,773	7,307	1,416	5,603	691	784	68	681	80	2,267
	Cow-units ..	67,631	77,057	81,625	64,845	55,547	58,187	53,724	55,095	53,151	64,824	62,673
	Fees (Rupees).	9,767	13,816	15,988	12,701	10,366	10,380	9,233	9,497	9,334	13,653	11,330

* NOTE.—As the figures for 1923–24 are abnormal and are not in accordance with present four categories, the average figures have been taken for nine years only.

The statement shows that about 74 per cent of the grazing revenue is obtained from alien cattle, that on an average the number of cows grazed in the reserved forests is nearly four times the number of buffaloes, but that there are more buffaloes than cows amongst the alien cattle. Very few sheep are grazed in the Lower Godavari division. The mean grazing incidence is 4·3 acres per cow-unit.

142. *Fire protection.*—The fire season is from the middle of February until the middle of June, the worst months being April and May. The chief causes of forest fires in the Lower Godavari division, and the methods of fire protection adopted since 1904 when fire protection was first started, are briefly summarized in Chapter II, paragraph 78. At present the reserved forests are divided into three classes for the purpose of fire protection :—

(1) *Rigidly protected.*—All the reserved forests of Polavaram range except Marlagudem reserve ; the timber coupes in Polavaram range ; certain reserves of Peddapur range containing good stands of timber ; and the teak plantations in Peddapur and Gokavaram ranges.

(2) *Unprotected.*—All the reserved forests of Rajahmundry range except the Devancheruvu blocks ; the Sudikonda, Mallavaram and Tirumalayapalem reserves of Gokavaram range ; and the Marlagudem reserve of Polavaram range.

(3) *Partially protected.*—All the remaining reserved forests in the Lower Godavari division.

The distinction between 'rigidly protected' and 'partially protected' reserves is that, in the former, the entire boundary of the reserve, and the boundaries of all enclosures, are fire-traced annually ; whereas in the latter only the Agency line, and the district and mokhasa (zamindari) boundaries are fire-traced annually. Although the distinction still exists in Peddapur and Gokavarm ranges, in practice all the reserves in these two ranges are now treated alike : the only boundary lines that are to be fire-traced according to the estimates for 1933–34 are the Agency line and the district and mokhasa boundaries. The coastal reserves of Rajahmundry range are immune from damage by fire ; and fire protection is considered unnecessary in the Marlagudem reserve of Polavaram range and the Sudikonda, Tirumalayapalem and Mallavaram reserves of Gokavaram range. All the teak plantations in Peddapur and Gokavaram ranges are fire-traced annually ; likewise the exterior boundary of the entire area worked for timber in the Polavaram range. The exterior boundary lines and the enclosure lines are 40 feet wide in all ranges except the Peddapur range in which they are 30 feet wide. The boundary lines of the teak plantations in Peddapur range are 20 feet wide, and all coupe lines are 12 feet wide.

143. *Cost of fire protection.*—The estimated cost of clearing and burning exterior fire lines ranges from Rs. 2 to Rs. 4–4–0 per mile according to the extent of clearing and burning that is necessary. Interior lines cost from Re. 1–2–0 to Rs. 1–8–0 per mile. The cost of fire protection has been greatly reduced in recent years. In 1923 the expenditure on fire protection was Rs. 4,261, and in 1932 it had been reduced to Rs. 1,504. The system of rewards, referred to in Chapter II, paragraph 78, was abolished with effect from 1933–34—vide Conservator's R. Dis. No. 580/31, dated 6th January 1932—and this has reduced the fire protection estimate for this year to Rs. 645–7–3. The cost of fire-tracing the boundary of the Papikonda and Beddadanole reserves adjoining the Nizam's dominions, approximately 8 miles in length, is paid by the Collector and charged to the budget sub-head 29-A. Political.

SECTION 3.—SPECIAL WORKS OF IMPROVEMENT UNDERTAKEN.

144. *General remarks.*—The special works of improvement undertaken since the forests of the Lower Godavari division came under the control of the Forest department fall under two main heads—

A. Improvements in communications.
B. Improvements in the growing stock.

Apart from these special works, there is no doubt that conservancy, fire protection, and the abolition of the permit system, have done more good than is apparent on the surface, or can easily be assessed.

A. Improvements in communications.

145. *General remarks.*—The opening out and development of the forests of the Lower Godavari division have been greatly hampered by want of demand. Over the greater part of the division, particularly in the forests that need opening out, there is no demand for major forest produce, due mainly to cheap supplies obtainable from zamindari forests in closer proximity to the principal markets ; while there are extensive unreserves which meet the local demands. Consequently the construction of the roads that are necessary to open out the division has not been financially justifiable. A list of roads, buildings and wells constructed and maintained by the Forest department, showing the cost of constuction and the expenditure on maintenance during the past ten years, will be found in Appendix V of this working plan.

B. Improvements in the growing stock.

146. *General remarks.*—The special works undertaken towards the improvement of the growing stock comprise :—

(*a*) Sowings to supplement natural regeneration in the felled coupes.
(*b*) Attempts to re-stock the blanks in the mangrove forests.
(*c*) Experimental planting of teak in the Peddapur and Gokavaram ranges, and in parts of the Polavaram range where teak does not grow.
(*d*) Casuarina planting on the sea coast.
(*e*) Experimental sowings of sandal.

Each of these will be dealt with separately.

147. *Sowings in the felled coupes.*—Seeds of teak, *Xylia*, *Pterocarpus marsupium*, and other species have been sown, at various times in the felled coupes of the two Devancheruvu blocks, and in the Sudikonda, Mallavaram, and Tirumalayapalem reserves, to supplement natural regeneration and coppice. No records have been maintained to show the results of these sowings, but, as the sowings were not followed by any sort of tending it is doubtful that they have resulted in any improvement in the growing stock. Seeds of logwood obtained from Jamaica was sown in the felled coupes of Kandikuppa reserve in 1900, but the results were unsatisfactory.

148. *Attempts to re-stock the blanks in the mangrove forests.*—Several small scale experiments have been made to re-stock the blanks of Upputeru reserve with indigenous species, but they have all failed.

149. *Experimental planting of teak.*—There is no natural-grown teak in the Peddapur and Gokavaram ranges. In 1907 an experimental sowing of teak was made in coupe I of Sudikonda reserve and the results appear to have been sufficiently promising to justify an extension of the experiment ; but no serious attempts to raise teak were made until fourteen years later. In 1921, experimental plots of one acre were planted with one year old seedlings in the following reserves of Peddapur range :—Lingamparti, Peddagarrangi, Jaddangi, Aminbada, Vatangi and Rajavomangi. The following year a second series of one acre experimental plots were planted in the same reserves. The results varied greatly but they tended to show that teak could be raised successfully on suitable soil. In 1926, 2 acres were planted in Mallavaram reserve, and in 1927, 1½ acres were planted in Loddodi reserve, and 1½ acres in Vatangi reserve ; at the same time experimental planting was commenced in the neighbourhood of Sudikonda. The following statement shows the areas planted in Sudikonda, Mallavaram and Tirumalayapalem reserves between 1927 and 1932 :—

Year of planting.	Sudikonda reserve Felling Series B.		Tirumalayapalem reserve Felling Series A.		Mallavaram reserve Felling Series C.	
	Coupe number.	Area planted (acres).	Coupe number.	Area planted (acres).	Coupe number.	Area planted (acres).
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1926	Nil.	Nil.	Nil.	Nil.	VIII	2·0
1927	Nil.	Nil.	VII	2·0	IX	2·0
1927	Nil.	Nil.	VIII	2·5	Nil.	Nil.
1928	XI	2·0	III	0·1	IX	2·0
1928	Nil.	Nil.	IX	1·0	X	2·0
1928	Nil.	Nil.	IX	2·5	Nil.	Nil.
1929	XII	2·0	X	2·0	Nil.	Nil.
1930	Nil.	Nil.	XI	2·0	XI	2·0
1931	XIII	10·0	XII	10·0	XII	10·0
1932	XVI	10·0	XIII	10·0	XIII	10·0
Total ..	..	**24·0**	..	**32·1**	..	**30·0**

In 1928, experimental planting was started at Amayyagoppu in Rajavomangi reserve, and continued in 1929 and 1931. Details relating to the experimental teak plots in Peddapur and Gokavaram ranges will be found in the plot files at the District Forest Office. The experimental planting has shown that teak can be grown successfully in Peddapur and Gokavaram ranges, on suitable soils.

150. *Casuarina planting.*—The Casuarina plantation that was started in Kandikuppa reserve in 1899 and closed in 1923, which has been referred to earlier in this chapter, was not a financial success, due to the high cost of formation which at the time appeared to be justified by an over-estimate of the anticipated yields. The second plantation at Kandikuppa, started in 1923, on a rotation of 10 years, is now fully established. The cost of formation was low and it promises to be highly remunerative. A small experiment was made in planting Casuarina in Coringa Extension reserve. It was abandoned in 1932. This experiment has shown that Casuarina can be raised on the Coringa sand-spit, but that it is uneconomic to do so at the present time when there is insufficient labour available to work the adjoining mangrove forests to their full capacity. Later, when the mangrove forests decline, a Casuarina plantation on the Coringa sand-spit will probably prove very successful.

151. *Experimental sowings of sandal.*—At present there are about 150 sandal trees scattered over the Peddapur, Gokavaram and Rajahmundry ranges. They are the results of sowings made at odd times and in odd places. The largest trees seen while this working plan was being prepared measured 1 foot 10 inches, 13 inches, and 12 inches in girth. The surviving trees represent a very small percentage of the sowings ; and that they have persisted is due more to the hardihood of sandal than to the suitability of the locality for the propagation of sandal.

SECTION 4.—PAST YIELDS.

152. *Past yield.*—The information available regarding past yields has been compiled chiefly from figures furnished by the coupe contractors. In the timber coupes of Beddadanole and Kopalli reserves, the material removed by the contractors was only a part of the yield ; and in these coupes, as well as the fuel coupes of Gokavaram range, the produce was arbitrarily classified as timber and fuel by the contractors themselves. For the purpose of this working plan, an attempt was made to correlate the reported yields with the areas worked and the prices paid for the coupes, but the results were so erratic that the investigation was abandoned. As the figures showing past yields serve no useful purpose and may be misleading, they have not been incorporated in this chapter.

153. *Past revenue and expenditure.*—The following statement show, the revenue and expenditure during the past ten years in the Lower Godavari division, excluding the Rampa Agency which is outside the area covered by this working plan :—

REVENUE AND EXPENDITURE RELATING TO THE LOWER GODAVARI DIVISION.

For the period (1925–26) to (1932–33).

REVENUE.

Particulars.	Year.								Averages.
	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	1930–31.	1931–32.	1932–33.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	
VIII. Forest Receipts.									
(a) Timber and other produce removed from the forests by Government Agency—									
Other produce—									
Timber	439	5,784	200	2,241	232	522	488	3,295	1,650
Firewood and charcoal ..	22	72	366	7	2,498	1,995	1,655	2,461	1,135
Bamboos	..	..	..	10	..	..	..	..	1
Other minor produce ..	..	5	4	7	59	..	2	7	11
(b) Timber and other produce removed from the forests by consumers or purchasers—									
Forest department—									
Timber	5,083	6,234	4,199	6,255	9,643	6,198	4,425	6,241	6,035
Firewood and charcoal ..	82,696	85,079	67,585	71,097	57,085	48,103	36,421	52,762	62,603
Bamboos	17,806	26,802	15,132	16,532	32,594	39,210	22,195	23,835	24,263
Grazing and fodder grass.	15,916	12,548	11,915	13,041	10,432	10,571	11,639	9,751	11,977
Other minor produce ..	28,682	6,150	6,720	6,944	10,423	6,216	5,216	5,652	9,500
Revenue Department—									
Timber	13,685	8,919	8,851	10,752	10,481	7,217	4,783	3,980	8,583
Firewood and charcoal ..	1,829	2,062	2,393	1,586	1,668	1,445	1,427	965	1,671
Other minor produce ..	15,384	13,431	12,424	29,196	35,924	23,644	20,360	18,355	21,090
(c) Drift and waifwood and confiscated forest produce.	2,317	2,379	2,804	3,464	3,550	3,030	2,250	2,546	**2,792**
(d) Miscellaneous—									
Fines and forfeitures	4,154	1,914	1,875	2,001	3,032	2,924	1,180	3,815	**2,612**
Rents of buildings	323	812	965	1,519	1,789	1,229	1,778	2,102	**1,314**
Other sources	12,526	9,486	9,935	10,909	12,396	8,293	6,563	3,688	**9,225**
Total ..	**2,00,862**	**1,81,677**	**1,45,368**	**1,75,561**	**1,91,806**	**1,60,597**	**1,20,382**	**1,39,455**	
(e) Deduct refunds	7,952	843	1,331	354	4,178	2,481	202	72	
Grand total ..	**1,92,910**	**1,80,834**	**1,44,037**	**1,75,207**	**1,87,628**	**1,58,116**	**1,20,180**	**1,39,383**	

REVENUE AND EXPENDITURE RELATING TO THE LOWER GODAVARI DIVISION—*cont.*

For the period (1925–26) *to* (1932–33)—*cont.*

EXPENDITURE.

Particulars.	Year.								Averages.
	1925–26.	1926–27.	1927–28.	1928–29	1929–30.	1930–31.	1931–32.	1932–33.	
(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
	RS.	RS.	RS.	RS	RS.	RS.	RS.	RS.	
8. *b. Conservancy and Works.*									
A. Forest produce removed by Government agency—Voted—									
Timber	5	2,097	798	..	..	668	623	12	525
Firewood and charcoal ..	..	..	306	..	41	14	..	..	45
Grass and other minor produce.	4	17	33	26	107	35	160	88	59
B Timber and other produce removed from the forest by consumers and purchasers ..	13,397	13,295	12,010	12,295	11,669	11,645	10,808	9,937	11,882
C. 1. Feed and upkeep of cattle.	..	..	..	..	851	755	512	340	307
2. Renewals or replacements of stores, tools and plant—	8,270	7,641	5,695	2,206	2,530	1,479	5,998	2,892	4,589
D. 1. Roads and bridges.. ..	1,460	774	884	1,251	1,201	1,537	1,314	1,961	1,298
2. Buildings	3,113	2,260	2,154	2,212	2,967	1,854	2,500	2,400	2,433
3. Other works	20	21	..	..	38	..	46	97	28
E. *a.* Demarcation	550	710	147	542	..	..	..	1,508	432
b. Fire protection	3,347	2,558	2,389	2,341	2,199	2,168	1,661	1,276	2,242
c. Other works	425	873	642	693	984	149	190	142	512
Forest surveys	..	40	6	16	..	..	..	..	8
d Regeneration	85	1,473	1,658	2,015	3,040	590	810	991	1,333
F. Other charges—Non-voted—									
Rates and taxes	163	11	56	16	279	341	353	209	179
Voted—Honoraria	..	..	..	..	..	16	11	..	3
Miscellaneous	..	..	..	22	..	..	3,742	3,109	859
Drift and waif wood	..	..	4	..	7	14	..	..	3
Rent of leased forests	..	..	..	..	2,535	4,465	..	..	875
8. *c. Establishments.*									
A. 1. Pay of officers—									
Non-voted	1,341	1,053	9,941	8,992	9,795	10,395	11,889	24,942	9,734
Voted	8,073	7,132	7,690	4,609	..	3,070	..	6,133	4,588
A. 2. Pay of establishments—									
Voted	45,641	45,319	43,380	42,029	39,187	43,005	42,471	44,724	39,470
A. 3. Allowances—Non-voted—									
Travelling allowances ..	..	..	2,241	1,853	1,903	2,150	2,061	3,592	1,725
Voted—									
Travelling allowances ..	8,168	7,332	9,819	7,253	5,617	5,065	5,170	4,832	6,657
Fixed Travelling allowance.	2,943	2,859	2,295	2,047	2,009	2,256	2,062	1,682	2,269
Other compensatory ..	411	870	795	923	885	838	667	551	743
A. 4. Contingencies and supplies and services—Non-voted—									
Rates and taxes	386	298	246	441	140	413	208	298	304
Voted—									
Rents	184	304	4,162	2,064	1,004	1,658	1,636	1,923	1,617
Books and periodicals ..	..	..	..	..	..	2	..	..	..
Supplies and seirvices ..	..	193	173	..	129	105	108	207	114
Contingent charges ..	3,092	3,030	3,134	2,767	2,789	..	725	2,616	2,269
Miscellaneous	282	16	19	29	1,144	3,004	1,953	13	808
Telephone charges ..	..	..	..	..	..	150	38	..	24
52-*A. Capital Outlay on Forests.*									
A. *a.* Forest Surveys	..	..	..	..	..	2,112	..	..	264
B. Organization, improvements and extension of forests—Reserved—									
A. Demarcation—Voted ..	91	75	839	1,740	2,033	1,000	..	21	725
B. Sowing and planting ..	1,316	..	..	..	..	2,111	2,431	1,759	952
C. Miseellaneous	..	..	..	..	..	24	..	..	3
C. Communications and buildings—									
A. Roads and bridges ..	..	..	874	225	3,502	4,826	1,916	..	1,418
B. Buildings	75	5,695	3,718	3,705	2,299	3,277	534	594	2,487
C. Other works	838	307	..	299	..	..	..	..	181
D. Stores– Tools and plant ..	..	382	56	904	336	93	..	41	227
Total, Expenditure ..	1,03,680	1,06,635	1,16,164	1,03,515	1,01,220	1,11,284	1,02,597	1,18,890	..
Add—Surplus ..	89,230	74,199	27,873	71,692	86,408	46,832	17,583	20,493	58,039
Grand total ..	1,92,910	1,80,834	1,44,037	1,75,207	1,87,628	1,58,116	1,20,180	1,39,383	..

Remarks.—(1) Prior to the year 1925–26, the classification differed slightly, chiefly in relation to the revenue from the forest produce collected by the Revenue Department. As it is not been possible to reclassify the revenue accurately the figures shown in this statement cover a period of eight years only.

2. The revenue and expenditure relating to the Rampa Agency is not included in this statement.

CHAPTER VI.—STATISTICS OF GROWTH AND YIELD.

SECTION 1.—GROWTH.

154. *Rate of growth of the principal species in the mangrove swamps.*—The chief species in the mangrove swamps of the Lower Godavari division are: Tella mada—*Avicennia marina*, Nalla mada—*Avicennia officinalis*, Tilla—*Excoecaria agallocha*, and Thanduga—*Lumnitzera racemosa*. The first two species are regenerated mainly from seed, and the other two mainly by coppice. During the preparation of the working plan a series of coupes of known ages was measured in order to determine the rate of growth of all four species. The coppice crops of Thanduga and Tilla were measured in Upputeru reserve, where no difficulty was experienced in locating crops of known ages. The measurements of Tella mada and Nalla mada were made in Coringa and Coringa Extension reserves. The mada

forests are regenerated partly by advance growth and partly from seed which drifts into the felled coupes, consequently the age of the new crop is not always the same age as the coupe. Apart from this, the extent of inundation and the depth of silt overlaying the sand beds influence the rate of growth, and the quality of the crop differs greatly within short distances. In order to counteract these factors a large number of measurements were taken at random over a wide range so as to obtain as extensive a sampling as possible. The two Avicennias are low-branched trees, and a high percentage of the stems branch below breast height making it necessary to take more than one measurement for each tree. Because of these facts, and the inaccuracies inherent in the method adopted for measuring the crops, the results are probably defective from a statistical point of view, but they are accurate enough for the purposes of this working plan.

Age.	Seedling crops.				Coppice crops.			
	Tella mada.		Nalla mada.		Thanduga.		Tilla.	
	Height.	Girth.	Height.	Girth.	Height.	Girth.	Height.	Girth.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
YEARS.	FEET.	INCHES.	FEET.	INCHES.	FEET.	INCHES.	FEET.	INCHES.
1	2·0	Under breast height.	1·7	Under breast height.	..	..	..	..
2	2·4		2·4		8·3	2·4	8·4	2·5
3	4·8		3·1		..	..	..	..
4	7·3	1·8	6·8	1·4	9·0	3·5	10·0	4·2
5	8·6	2·8	8·5	3·1	..	..	..	..
6	9·0	3·2	8·8	3·6	13·5	5·2	13·0	4·9
7	9·4	3·6	7·9	4·1	..	..	..	..
8	10·1	4·7	10·9	6·7	13·7	7·4	14·0	6·4
9	12·1	5·7	15·5	7·7	..	..	..	..
10	..	..	..	..	19·7	8·8	18·3	7·9
12	..	..	..	..	19·3	9·0	19·2	10·0
16	20·0	10·5	19·1	10·6	..	..	..	..
21	19·8	12·2	..	..	..	..	..	..

NOTE.—The graphs relating to these figures will be found in the data book filed with the working plan records.

155. *The mean rate of growth for the Madas of Coringa and Coringa Extension reserves, and the coppice crops of Upputeru reserve.*—It has been estimated that, in Coringa and Coringa Extension reserves combined, there is twice as much Tella mada as Nalla mada; while, in Upputeru reserve, Thanduga and Tilla occur more or less in the same proportion. In determining the mean rate of growth, proportionate weightage was given to the figures for Tella mada, while the mean figures were taken for the chief species in Upputeru reserve. The mean figures were plotted and smooth curves drawn from which the following results were obtained :—

Age.	Mada crops.		Coppice crops of Thanduga and Tilla.	
	Mean height.	Mean girth.	Mean height.	Mean girth.
(1)	(2)	(3)	(4)	(5)
YEARS.	FEET.	INCHES.	FEET.	INCHES.
1	..	..	..	..
2	3·4	..	6·0	2·2
3	4·8	..	8·0	3·1
4	6·2	1·7	10·0	3·9
5	7·8	2·4	12·0	4·8
6	9·0	3·3	13·2	5·0
7	10·2	4·4	14·6	6·3
8	11·5	5·7	15·6	7·0
9	12·7	6·7	16·8	7·7
10	13·7	7·4	17·8	8·4
11	14·6	8·2	18·8	9·0
12	15·7	8·8	19·6	9·5
13	16·6	9·3	20·6	10·0
14	17·5	9·8	21·1	10·6
16	19·0	10·7	..	..
18	20·5	11·4	..	..
20	21·8	12·0	..	..

NOTE.—The average of 600 stools of all ages from 2 to 12 years showed 2 shoots per stool for Thanduga and 5 shoots per stool for Tilla.

The graphs relating to these figures will be found in the data book filed with the working plan records.

156. *The significance of the rings in the Avicennias.*—The wood of the Avicennias of the Lower Godavari division exhibits well-marked rings which may be mistaken for annual rings. If they are examined it will be found that they bifurcate and run into each other; and, if the rings are counted along several radii, the number on each radius will not be the same. No information is available regarding the significance of these rings—they probably are intraxylory phloem bands; but the results of counting the rings on a large number

of stools of trees felled in coupes of known ages has shown that, on an average, three rings are produced each year in crops up to 20 years of age. Consequently, if the number of rings in a stool is devided by 3 the result gives the approximate age of the tree.

157. *The rate of growth of teak in the Polavaram range.*—Stem analyses of 12 type trees, ranging in girth from 3 feet 1·4 inches to 4 feet 1·5 inches over bark at breast height, selected in different parts of Polavaram range, gave the following mean results :—

Age.	Height.	Diameter at B.H. over bark.	Volume (under bark).	Remarks.
(1)	(2)	(3)	(4)	(5)
YEARS.	FEET.	INCHES.	C.FT.	
5 ..	10·5	2·4	..	
10 ..	23·5	3·9	0·6	
15 ..	33·5	5·2	1·6	
20 ..	40·5	6·2	3·0	
25 ..	46·0	7·3	4·8	
30 ..	50·5	8·2	7·0	
35 ..	54·0	9·0	9·4	
40 ..	57·0	9·8	12·2	
45 ..	60·0	10·5	14·9	
50 ..	61·5	11·2	17·8	
55 ..	63·5	11·8	20·6	
60 ..	64·5	12·3	22·6	

The measurements of the 12 trees analysed are as follows :—

No.	Height.		Girth over bark at B.H.	
	FEET.	INCHES.	FEET.	INCHES.
1	67	6	3	9·4
2	77	6	3	11·0
3	65	0	3	7·4
4	63	6	3	3·6
5	69	6	3	3·3
6	62	6	3	4·1
7	67	6	3	8·5
8	65	0	3	6·3
9	61	6	3	5·8
10	68	6	3	11·1
11	64	6	4	1·5
12	62	6	3	1·4

Many of the trees analysed showed marked periods of suppression.

NOTE.—The graphs relating to these figures will be found in the data book filed with the working plan records.

158. *Measurements of the young teak plantations in Peddapur and Gokavaram ranges.*—The following statement shows the height and girth of the experimental plantations created between 1927 and 1930 in parts of the Peddapur and Gokavaram ranges. The measurements were recorded in July 1932.

Location.	Method of formation.	Age.	Mean height.		Mean girth.	Remarks.
(1)	(2)	(3)	(4)		(5)	(6)
		YEARS.	FT.	IN.	INCHES.	
1 Tirumalayapalem Felling Series A, Coupe X.	Seed dibbled, 6′ × 6′.	3	15	4	4·4	Area—2 acres. Soil—Fairly stiff lateritic soil.
2 Tirumalayapalem Felling Series A, Coupe IX.	Seed sown broadcast after ploughing.	4	19	0	6·3	Area—1 acre. Soil—Dry, brown-non-lateritic.
3 Tirumalayapalem Felling Series A, Coupe VIII.	Seed dibbled, 6′ × 6′.	5	27	0	9·2	Area—1·5 acre. Soil—a deep light sandy loam.
4 Do.	Stump-planted, 6′ × 6′	5	27	0	9·4	Area—1 acre. Soil—a deep light sandy loam.
5 Tirumalayapalem Felling Series A, Coupe XI.	Seed dibbled, 6′ × 6′.	2	7	9	3·3	Area—2 acres. Soil—a light sandy soil.
6 Sudikonda Felling Series B, Coupe XII.	Stump planted 6′ × 6′.	3	12	0	4·9	Area—2 acres. Soil—a reddish soil—fairly stiff.
7 Rajavomangi reserve ..	Seed dibbled, 6′ × 6′.	4	15	0	5·8	Area—2 acres. soil—a full loam.

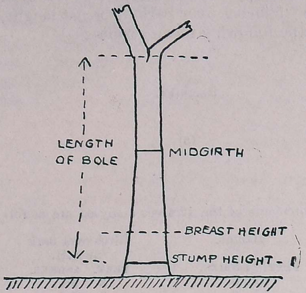
159. *Form factors of teak and its associate species.*—In enumerating the timber areas of Papikonda reserve and Kovvada block II, measurements were recorded of the diameter at breast height over bark in 4-inch classes, and of the approximate length of bole up to the first main branch. The crop was measured down to 4 inches in diameter. In order to compute the quantity of timber in the growing stock, it was necessary to prepare local form factors to convert the cylindrical volumes, obtained by multiplying the sectional area at breast height by the length of the bole, into actual quantity of timber measured under bark. For this purpose an average of 12 to 14 standing trees in each diameter class of each species, were measured over as wide an area as possible, the following measurements being recorded :—

(*a*) Girth at breast height over bark.

(*b*) Length of bole from stump height to first branch.

(*c*) Mid-girth—at $\frac{1}{2}$ length of bole.

(*d*) Thickness of bark.



The form factors were worked out on the following formula :—

$$\frac{\text{Sectional area at mid-girth under bark} \times \text{Length of bole.}}{\text{Sectional area at breast height over bark} \times \text{Length of bole.}}$$

Separate timber form factors were computed for each diameter class, and the mean results for all classes were as follows :—

Teak	·55
Terminalia tomentosa	·52
Rosewood	·57
Xylia xylocarpa	·58
Pterocarpus marsupium	·59
Anogeissus latifolia	·65
Miscellaneous species	·57

SECTION 2.—YIELD.

160. *Estimated yield from the Kandikuppa Casuarina plantation.*—At present no figures are available to show the yield that may be expected from the final crop in the Kandikuppa Casuarina plantation. The only crop that had attained the rotation-age of 10 years when the working plan was being prepared was an experimental plot of 15 acres planted in 1923 at an espacement of 6′ × 6′. This plot had been thinned experimentally under various methods in 1929, and the average number of stems per acre in the final crop averaged about 420, equivalent to a fully stocked crop with an espacement of 10′ × 10′. The quality of this plantation is markedly better than the average quality for the whole plantation, and it is more heavily stocked. The crop next in age—coupe I of 1924—is about the poorest in the whole plantation ; and, being under 10 years of age, it was unsuitable for measurement. In 1933 it was found necessary to lay out a one-acre plot to be maintained for the production of seed, and advantage was taken of this to collect figures of yield. A plot measuring ·9 acre was laid out in a fully stocked area of the best quality in the 1923 plantation. Sixty-one trees were marked for retention as seed-bearers : all were dominant or predominant stems and were distributed evenly throughout the plot. The mean girth of these trees was 20·9 inches. The rest of the crop was felled, and six sample trees, approximately 20·9 inches in girth, were measured and averaged, the mean yield being 9 c.ft. of stemwood ; therefore the estimated yield of the trees left standing was 549 c.ft. or approximately 20 cubic yards. The portion of the crop that was felled yielded 82 cubic yards, making a total yield of 102 cubic yards, stacked, for ·9 acre, or 112 cubic yards, stacked, per acre. Mr. D. E. Hutchins, after numerous experiments in the Nellore district, estimates the weight of greenwood at 70 lb. per c.ft., and dry wood at about 50 lb. per cubic foot. In his "Manual of Indian Timbers," Gamble states that 50 lb. per cubic foot is a good average for young wood, and 60 lb. per cubic foot, for the wood of old trees. These figures more or less agree with those in use at Kandikuppa, namely ; 1 ton = 81 cubic feet, or 3 cubic yards of stacked fuel, and 54 cubic feet solid. Adopting these figures, the yield of 112 cubic yards stacked is equivalent to 37 tons per acre. Six

months later the whole of the 1923 plantation, excluding the seed plot and its surrounds, was felled and measured by the District Forest Officer ; the yield is shown in the following statement :—

Unit.	Billets.		Branchwood.		Poles.			Brushwood.		Remarks.
	Volume in cubic yards.	Weight in tons.	Volume in cubic yards.	Weight in tons.	Number.	Quantity in cubic feet.	Weight in tons.	Quantity in head-loads.	Weight (approximate).	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Yield for whole coupe.	1,201	487·51	204	35·10	660	1,128	28·20	400	10·00	Age—10½ years.
Yield per acre ..	101	41·14	17	2·96	56	952	2·38	34	0·85	Area—11·85 acres.

Note.—(1) The quantity in column 8 has been calculated on the basis of 40 c.ft. = 1 ton, and column 10 at 40 headloads per ton.
(2) The total yield = 47·33 tons per acre.

In this statement a ton has been considered equivalent to 66.4 cubic feet stacked, and 40 cubic feet, solid ; presumably the fuel was weighed green immediately after felling. If the yield of stemwood were converted into tons at the usual rate of 3 cubic yards stacked and 54 cubic feet solid, the result would have been as follows :–

(*a*) 101 cubic yards of billets at 3 cubic yards per ton .. .. = 33·66 tons.

(*b*) 95·2 cubic feet of poles at 54 cubic feet per ton .. .. = 1·76 ,,

Total .. 35·42 tons.

The yield from the one-acre seed plot was estimated at 37 tons per acre, but it was of better quality than the average crop in the 1923 plantation and was measured six months earlier. A good round figure for a fully stocked crop of the best local quality would be 35 tons per acre, and this will be taken as the basis for calculating the average yield for the whole plantation. An analysis of six one-acre sample plots showed that in the Kandikuppa plantation with an espacement of 7′ × 7′ and 900 stems to the acre, the average loss would be—

	percentage of the full crops.
(*a*) Dead trees per acre	4
(*b*) Suppressed trees per acre	5.8
(*c*) Planting spaces occupied by wells	4
(*d*) Casualties, windfalls, etc.	21
Total loss ..	34·8

After thinning and at maturity, the number of stems left in the final crop would be only 33 per cent of the initial crop, or approximately 300 stems per acre. This may be improved by more careful thinnings ; but it must be remembered that apart from the number of stems per acre, the average quality of the Kandikuppa plantation is inferior to the 1923 plot which yielded 35 tons per acre. Taking all factors into consideration, a fair estimate of the yield for the whole plantation would be 65 per cent of the yield from the 1923 plot or in round figures, 23 tons per acre. The yield of branchwood from the final crop is estimated at 2 tons per acre making a total yield of 25 tons per acre from the final crop. The intermediate yield from thinning and pruning, based on actuals, is estimated at about 5 tons per acre ; thus the total yield for the whole rotation of 10 years is estimated at 30 tons per acre, equivalent to a mean yield of 3 tons per acre per annum.

161. *Investigation of the rotation in the fuel forests of Devancheruvu reserve.*—The two Devancheruvu blocks, which are situated within a few miles of Rajahmundry, are worked intensively for fuel. At present they are worked as simple coppice on a rotation of 25 years ; and it was thought that it might be more profitable to reduce the rotation. This matter was investigated in the following manner :—The age of the oldest coupe worked by simple coppice in the two felling series is 22 years, and a series of sample plots, all reasonably comparable, was selected, felled, and measured in coupes from 14 to 22 years of age, four one fourth acre plots being selected in the same type of forest in different parts of each coupe. On account of the difficulty of accurates ampling the results were slightly erratic, but they tended to show that the current volume increment per acre was still rising at 22 years and, as the mean volume increment culminates later than the current volume increment, it was unnecessary to reduce the rotation.

162. *Estimate of the capital value of the forest.*—No attempt has been made to estimate the capital value of the forest : with the data available, this is impracticable.

PART II.

Future Management discussed and prescribed.

CHAPTER I.—BASIS OF PROPOSALS.

SECTION 1.—GENERAL OBJECTS OF MANAGEMENT.

163. *General objects.*—The general objects of management are —

(1) to provide for the exercise of all privileges to grazing and forest produce, but to guard against these privileges maturing into rights or developing into extravagances ;

(2) to meet the demand for timber, fuel, bamboos and minor forest produce by working suitable areas on the principles of correct silviculture and sound management, and in so doing to develop both the demand and outturn from these areas ;

(3) to increase the value of the forest by introducing teak wherever it is likely to grow well ; and

(4) finally, to conserve, as efficiently as possible, the large areas that cannot be worked profitably at the present time.

It is hoped that management on these general lines will ensure progressive improvement of the growing stock, and a steadily increasing revenue.

164. *Normality.*—Wherever a demand exists and the forests can be worked regularly, the management aims at the establishment of normal regeneration, a normal increment, and ultimately a sustained yield. Normality, however, is a relative term ; and, taking the forests of the Lower Godavari division as a whole, it is at present impossible to conceive normality in any tangible form. Over the greater part of the division the forests are incompletely stocked with inferior timber and fuel for which there is no demand ; the soil sets a very definite limit to silvicultural improvement ; and financial considerations rule out the little that can be attempted. In such areas normality, even as an ideal, must remain below the horizon for many decades. Yet, although the objects of management are not definitely oriented on normality, the general outlook and movement is in that direction.

SECTION 2.—METHODS OF TREATMENT TO BE ADOPTED.

165. *Forest types.*—There are five distinct types of forest in the Lower Godavari division :—

(1) the mangrove forests,
(2) the casuarina plantations,
(3) the teak forests,
(4) the mixed deciduous forests, and
(5) the bamboo forests.

Each of these types will receive different treatment.

166. *The mangrove forests.*—In the mangrove forests of Coringa and Kandikuppa reserves, where the Avicennias predominate, the method of treatment will be clear-felling with natural regeneration ; and in the mangrove forests of Upputeru reserve, where species that coppice form about 90 per cent of the crop, the method of treatment will be simple coppice.

167. *The casuarina plantations.*—The casuarina plantations will be worked by clear-felling and planting.

168. *The teak forests.*—The teak forests fall naturally into three sub-types ; low-level teak, high-level teak, and scattered teak. The low-level teak forests occur in the northern half of Beddadanole reserve and on the lankas of Kopalli reserve and Kovvada Block I. These forests have been neglected in the past and regeneration is defective everywhere. They will be treated on what is known as the "Walayar method" : the coupe will be clear-felled, and regeneration will be obtained from coppice supplemented by teak stumps so as to obtain the requisite density. The high-level teak forests occur in the neighbourhood of Ravigudem and Chilekalur in Papikonda reserve, and in Kovvada Block

II. These forests have not been worked for many years on account of the unhealthiness of the locality, the shortage of labour, and the difficulty of extraction. An attempt will be made to work these forests on a composite method of treatment ; the well-stocked areas in each coupe will be clear-felled and planted, and the mature and overmature timber that is saleable will be removed from the rest of the coupe by selection fellings, the regeneration of the gaps being left to nature. The scattered teak forests are of very poor quality and cannot be worked profitably at present.

169. The two Devancheruvu blocks, situated astride the Madras road from four to seven miles from Rajahmundry, and parts of the Sudikonda, Tirumalayapalem, and Mallavaram reserves adjoining the Jaggampeta-Gokavaram road, are the only areas in the mixed deciduous forest where there is a demand for fuel. These areas will be worked as simple coppice.

170. On the river terraces, or lankas, of the mixed deciduous forests, which occur chiefly in the northern half of Peddapur and Gokavaram ranges, there are good stands of miscellaneous timber which can be worked at a profit, and the soil is suitable for growing teak. These areas will be clear-felled and planted with teak.

171. The bamboo forests have hitherto been worked as if bamboo were a weed requiring little silvicultural attention. An attempt will now be made to regulate the fellings by enforcing a few simple practical rules. The method of treatment will be partial clear-felling.

SECTION 3.—WORKING CIRCLES, THEIR AREA AND DISTRIBUTION ; REASONS FOR THEIR CONSTITUTION.

172. *Division into working circles.*—As the eight forest types and sub-types which have just been discussed will be given separate silvicultural treatment, each will form a separate working circle. All areas open to grazing will be grouped together in one working circle, and likewise, all areas from which minor forest produce will be collected. The forests have therefore been divided into ten working circles.

I. The Mangrove Clear-felling Working Circle.

173. All areas that can be worked for fuel in the mangrove forests of Coringa and Kandikuppa reserves in the East Godavari district are included in this circle. The Avicennias form about 75 per cent of the growing stock, and regeneration will be obtained mainly from seed. The yield will be utilized partly for the supply of fuel to Cocanada port and town, and partly for local consumption. The area of the working circle is 27,136 acres.

II. The Mangrove Coppice Working Circle.

174. All areas that can be worked for fuel in the mangrove forests of Upputeru reserve in the West Godavari district are included in this circle. Tilla, *Excoecaria agallocha* and Tanduga—*Lumnitzara racemosa* form about 90 per cent of the growing stock, and regeneration will be obtained mainly from coppice. The yield will be utilized for local consumption. The area of the working circle is 6,126 acres.

III. The Casuarina Plantation Working Circle.

175. The Kandikuppa Casuarina plantation, and the narrow strip of land along the western and southern boundaries where it is proposed to extend the plantation, will comprise this circle. The yield will be utilized for the supply of fuel to Cocanada. The area of the working circle is 937 acres.

IV. The Timber Clear-felling Working Circle.

176. The teak lankas in the northern half of Beddadanole reserve, at the southern end of Kopalli reserve, and in the south-west corner of Kovvada Block I will be included in this circle. The yield will be utilized partly in supplying the markets at Ellore, Nidadavole, and Rajahmundry and partly to meet the local demand. The area of the working circle is 2,893 acres.

V. The Papikonda Experimental Working Circle.

177. The timber-bearing areas of Papikonda reserve and Kovvada Block II which contain teak, rosewood, *Terminalia tomentosa*, and *Pterocarpus marsupium* and other saleable timber, in sufficient quantity to ensure profitable working, will be included in this circle. The Rajahmundry market will absorb the entire yield. The area of the working circle is 3,703 acres.

VI. The Upland Coppice Working Circle.

178. The two Devancheruvu blocks, and part of the flat ground and lower slopes of Sudikonda, Tirumalayapalem, and Mallavaram reserves will be included in this fuel circle. The entire yield from the Devancheruvu blocks will go to Rajahmundry, and the markets at Peddapuram, Samalkot, Rajahmundry, and Cocanada will absorb the yield from the other three reserves. The area of the working circle is 7,787·5 acres.

VII. The Teak Conversion Working Circle.

179. The object of this circle is to improve the value of the forest by planting teak wherever it can be grown successfully ; and, while doing so, to find and establish markets for the natural grown timber. This circle will include all areas in Peddapur and Gokavaram ranges which contain good stands of saleable timber, and in which the soil is believed to be suitable for planting teak. The area of the working circle is 1,170 acres.

VIII. The Bamboo Working Circle.

180. All the forests of the division which contain bamboo in sufficient quantity for remunerative working are included in this circle. It will cover the greater part of the Polavaram, Gokavaram and Peddapur ranges. The area of the working circle is 190,180 acres.

IX. The Minor Produce Working Circle.

181. The circle covers the whole division, the area being 296,547 acres.

X. The Grazing Working Circle.

182. This circle will cover the entire area that is open to grazing, and it will overlap all other working circles. The locality and area included in this circle will vary from year to year depending on the coupes that are open and closed to grazing according to the prescriptions of the working plan. As work develops, the area open to grazing will decrease slightly. The mean area of the working circle during the period of the plan will be 277,325 acres.

183. The distribution of the working circles is shown in the following statement :—

Name of working circles.	Area of working circle in				Total area of working circle.
	Rajahmundry range.	Polavaram range.	Gokavaram range.	Peddapur range.	
(1)	(2)	(3)	(4)	(5)	(6)
	ACS.	ACS.	ACS.	ACS.	ACS.
Mangrove clear-felling	27,136·0	..	..	..	27,136
Mangrove coppice	6,126·0	..	..	..	6,126
Casuarina plantation	937·0	..	..	..	937
Timber clear-felling	..	2,893	..	..	2,893
Papikonda experimental	..	3,703	..	..	3,703
Upland coppice	2,064	..	5,723·5	..	7,787·5
Teak conversion	..	..	384·0	786	1,170
Bamboo	..	39,668	54,136·0	96,376	190,180
Minor produce	80,283·0	59,602	54,135·0	102,527	296,547
Grazing	65,547·0	57,416	51,948·0	102,414	277,325

SECTION 4.—PERIOD OF WORKING PLAN AND NECESSITY FOR INTERMEDIATE REVISION.

184. *General.* The period of the working plan will be ten years : from 1st April 1934 to 31st March 1944. During this period it will probably be necessary to amend the prescriptions for the Papikonda Experimental Working Circle on experience gained during the construction of the skidway, and the first two or three years working. No other intermediate revision is anticipated.

CHAPTER II.—WORKING PLAN FOR THE MANGROVE CLEAR FELLING WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION OF THE CIRCLE AND CHARACTER OF THE VEGETATION.

185. *Constitution of the Working Circle.*—The working circle covers all the forests in which the Avicennias predominate. It includes the whole of Coringa reserve to the east of the Varava Kalava and the Coringa river; the whole of Coringa Extension reserve to the east of the Gaderu excluding the Godavari Point sandspit; and all the mangrove forests of Kandikuppa reserve except those that are now under panchayat management.

186. *Areas excluded from the Working Circle.*—The following areas in the Coringa reserves have been excluded from the working circle: compartments 1*a*, 1*b*, and 2*b*, which will be specially protected; compartments 2*a*, 3*a*, and 3 *b*, in which the greater part of the ground is above the *mada* level and there are several large blanks; compartment 22, the sandspit; the small island forming compartment 23*b*; and compartments 23*a*, 24, and 25, which are under water. In Kandikuppa reserve the following areas have been excluded: compartments 1*a*, 7*d*, 11 and 13, which are blank; compartments 1*b*, and 3, which have been ruined under panchayat management; compartments 2 and 10 which will be worked by panchayats; and compartment 12, the Casuarina plantation.

187. *General character of the vegetation.*—The most noticeable feature on Coringa and Coringa Extension reserves is the irregularity of the growing stock, even over comparatively small areas. This is due partly to differences in inundation, and partly to differences in the depth of the alluvial deposits overlaying the sand beds; but it is mainly the result of past working. It has already been mentioned—in Part I, Chapter V—that, during the past 40 years, the Coringa reserve has been worked under five different schemes, with rotations of 12, 40, 8, 10 and 25 years. For about a half of this period the silvicultural system was coppice with standards, although the two principal species do not coppice. Later, clear-felling was introduced but large areas in the annual coupes were left unfelled. Meanwhile extensive strips of ground bordering on the main creeks have risen above tidal influence forming large blanks. The present growing stock reflects the trial-and-error treatment to which these forests have been subjected: there are irregular patches of *mada* forest dotted with old standards and containing numerous small blanks; there are even-aged patches of *Tella-mada*, the result of clear-felling, interspersed with older and more irregular patches of growth representing the unworked portion of the clear-felling coupes; there are pure young even-aged crops of *Tella-mada* on some of the recent accretions; and finally there are large blanks fringed with *Nalla-mada* and strips of *Tilla* and *Guggilam*. The irregularity of the growth in the Coringa Extension reserve is due chiefly to differences in the soil. The Avicennias form about seventy-five per cent of the growth in the two Coringa reserves. The mangrove forests of Kandikuppa reserve are more open and stunted than the Coringa forests, and the Avicennias form about sixty-five per cent of the growing stock. The most noticeable feature in this reserve is the damage done by illicit fellings.

SECTION 2.—PERMANENT DIVISION INTO BLOCKS AND COMPARTMENTS.

188. *Division into blocks.*—The Coringa and Coringa Extension reserves have been divided into three blocks:—

(1) Coringa North block. This comprises the whole of the Coringa backwater south of a line joining Godavari Point and Chollangi Point. This line forms the northern boundary of the reserve.

(2) Coringa East block. This comprises the entire area east of the left bank of the Gaderu.

(3) Coringa West block. This comprises the entire area west of the left bank of the Gaderu.

The boundaries of these blocks are not altogether permanent: with the silting up of the Coringa backwater, fresh accretions will form, and the East and West blocks will gradually invade the North block, particularly in the neighbourhood of the mouths of the Mattlapadu yeru, the Coringa river and the Gaderu. The Kandikuppa reserve forms one block with the same boundaries as the reserve. The seashore at the southern extremity of the block is being eroded but the rest of the boundary is more or less permanent.

189. *Subdivision into compartments and sub-compartments.*—The whole of the Coringa North block being under water forms one compartment. Excluding the Godavari Point sandspit—compartment 22, the backwater to the east of the Hope Island—compartment 23, and the Gaderu—compartment 24, the Coringa East block has been subdivided into twelve compartments with a mean area of 1,195 acres. The Coringa West block has been subdivided into nine compartments with a mean area of 1,536 acres. The boundaries of all

the compartments are well-marked natural features : chiefly creeks. Most of the compartments are subdivided naturally by creeks ; and these subdivisions have been formed into sub-compartments mainly for location purposes.

Distribution and area statement for the Mangrove Clear-felling Working Circle.

Name of block.	Number of sub-compartment.	Area of sub-compartment.				Number of compartment.	Area of compartment.			
		Wooded.	Blank.	Total.	Creeks.		Wooded.	Blank.	Creeks.	Total.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Coringa, West	..	..	..	..	..	4	860·8	132·0	55·6	1,048·4
	..	..	..	..	..	5	947·6	215·2	25·2	1,188·0
	6 a	599·2	2·8	602·0	47·6	6	1,673·2	116·0	47·6	1,836·8
	6 b	1,074·0	113·2	1,187·2						
	7 a	1,130·4	40·4	1,170·8	40·8	7	1,552·4	153·6	40·8	1,746·8
	7 b	422·0	113·2	533·2						
	..	..	..	..	..	8	1,092·4	403·2	46·0	1,541·6
	..	..	..	..	..	9	1,460·8	32·8	34·0	1,527·6
Coringa, East	..	..	..	..	..	10	696·0	13·6	8·4	718·0
	..	..	..	..	..	11	1,446·0	134·8	48·0	1,628·8
	..	..	..	..	..	12	907·2	50·0	40·8	998·0
	13 a	1,266·0	13·6	1,279·6	104·4	13	1,523·6	13·6	104·4	1,641·6
	13 b	65·6	..	65·6						
	13 c	192·0	..	192·0						
	14 a	642·0	..	642·0						
	14 b	309·2	..	309·2						
	14 c	208·0	..	208·0	48·0	14	1,162·8	..	48·0	1,210·8
	14 d	3·6	..	3·6						
	15 a	798·4	9·6	808·0	37·2	15	832·8	9·6	37·2	879·6
	15 b	34·4	..	34·4						
	16 a	598·8	..	598·8	24·0	16	599·2	..	24·0	623·2
	16 b	0·4	..	0·4						
	17 a	877·6	..	877·6	106·4	17	1,012·4	..	106·4	1,118·8
	17 b	134·8	..	134·8						
	18 a	895·2	..	895·2						
	18 b	343·6	..	343·6	46·4	18	1,913·2	..	46·4	1,959·6
	18 c	674·4	..	674·4						
	19 a	321·2	34·4	355·6						
	19 b	749·2	..	749·2						
	19 c	196·0	..	196·0	56·4	19	1,304·4	34·4	56·4	1,395·2
	19 d	38·0	..	38·0						
	20 a	22·8	..	22·8						
	20 b	263·6	..	263·6						
	20 c	489·6	..	489·6						
	20 d	3·2	..	3·2						
	20 e	39·6	..	39·6	111·2	20	1,313·6	..	111·2	1,424·8
	20 f	31·6	..	31·6						
	20 g	40·0	..	40·0						
	20 h	162·0	..	162·0						
	20 i	184·4	..	184·4						
	20 j	76·8	..	76·8						
	..	..	..	..	..	21	699·8	..	38·4	738·2
Kandikuppa	..	..	..	..	..	4	591·0	14·0	95·0	700·0
	..	..	..	..	..	5	477·0	23·4	16·6	517·0
	6 a	225·5	27·2	252·7	11·8	6	425·0	55·2	11·8	492·0
	6 b	199·5	28·0	227·3						
	7 a	139·0	..	139·0						
	7 b	465·0	53·0	518·0	82·0	7	742·0	90·0	82·0	914·0
	7 c	138·0	37·0	175·0						
	..	..	..	..	..	8	584·0	99·0	71·0	754·0
	9 a	311·0	119·0	430·0	64·0	9	335·0	135·0	64·0	534·0
	9 b	24·0	16·0	40·0						
				Total area of the working circle	..		24,152·2	1,725·4	1,259·2	27,136·8

SECTION 3.—SUBDIVISION OF THE WORKING CIRCLE.

190. *The necessity for subdivision.*—The special objects of the working circle are—

(1) To supply the Port Conservancy Board, Cocanada, with its full requirements of fuel ; approximately 1,600 tons per annum.

(2) To supply as much fuel as possible to Cocanada town.

(3) To meet the demand for fuel from the fishing villages of Pandipallam and Pora in Kandikuppa reserve, as fully as the growing stock will permit.

The Coringa reserve will be worked for the first two purposes, and the Kadikuppa reserve for the third. It has been estimated that the most suitable size of the crop to meet the fuel requirements of Cocanada Port and Town is about 12 inches in girth at breast-height. The fisherman of Pandipallam and Pora require smaller fuel averaging about ten inches at breast-height. As the rate of growth in Coringa and Kandikuppa is more or less the same it will be necessary to work these reserves on different rotations. The special objects of management frequently make it necessary to adopt different rotations, or to modify the silvicultural system, in parts of a working circle. These modifications do not justify the formation of a separate working circle ; nevertheless it is desirable that an appropriate technical term should be used to draw attention to the modifications. The term 'Felling Series' does not fit : it already has a definite meaning ; besides, each of these divisions may contain several felling series. As there is no technical term in use which can be applied to these divisions, it has been decided to use the term sector : a sector being defined as part of a working circle in which the rotation has been altered, or the silvicultural system modified, to meet the special objects of management. The working circle will be divided into two sectors : the Coringa sector with an area of 23,225·8 acres and the Kandikuppa sector with an area of 3,911 acres. Each of these sectors will be divided into two or more felling series.

191. *Felling series and reasons for their formation.*—In the Coringa sector the area to be felled annually averages 929 acres. It is considered inadvisable to clear-fell so large an area in one locality: regeneration would be difficult, and large blanks would be formed; and, as the labour is obtained from several villages situated far apart, it would be difficult and expensive to concentrate work in one coupe. It has therefore been decided to subdivide the Coringa sector into three felling series :—

	ACS.
(1) The Coringa felling series	8,889·2
(2) The Hope Island felling series	6,197·2
(3) The Bhyravapalem felling series	8,139·4
Total area ..	23,225·8

The average area to be felled annually in the Kandikuppa sector is only 261 acres, but supplies have to be made to two different villages and dissensions will probably arise if the two villages obtain their supplies from a common coupe. The Kandikuppa sector will therefore be divided into two felling series, the area of each series being more or less proportionate to the population of the village that it serves :—

	ACS.
(1) The Pandipallam felling series	3,271
(2) The Pora felling series	640
Total area ..	3,911

SECTION 4.—ANALYSIS AND VALUATION OF THE CROP.

192. *Analysis of the crop.*—As the working circle will be managed solely for the production of fuel, a detailed analysis of the growing-stock is unnecessary; but the following stock-mapping was carried out :—

(1) The Avicennia forests were located on the maps to determine the limits of the working circle.

(2) All the mangrove forests in the division were re-surveyed on a scale of 4 inches= 1 mile. During the course of the surveys the blanks in each compartment were marked on the maps; and later, the areas that are wooded, blank and under water, were computed separately for each compartment, so that it would be possible to lay out approximately equi-productive coupes.

(3) The age gradations of the crop were marked on the field maps so that the coupes could be arranged in proper sequence.

No other analysis was necessary.

193. *Valuation of the crop.*—For want of reliable data it is not possible to make an accurate valuation of the growing stock.

SECTION 5.—METHOD OF TREATMENT.

194. *The silviculture of the principal species.*—The silvicultural requirements of *Avicennia marina* and *Avicennia officinalis*, which form the greater part of the growing stock, will determine the method of treatment to be applied to the working circle. The other two *Avicennias* are comparatively scarce and of little importance; and the chief auxilliary species are amenable to the same treatment as the principal species. The *Avicennias* of the East Godavari district are small trees—rarely over 25 feet in height—with low-branched rounded crowns. They are evergreen and gregarious, forming pure crops in favourable localities, but there are zones in which the two principal species mingle freely. The *Avicennias* are light demanders, and appear to be somewhat intolerant of crowding: for although young crops frequently grow in dense thickets, this does not appear to promote the development of long boles and conical crowns. The saplings thin out naturally, assuming the characteristic low branching and rounded crowns. Although they are light demanders, the *Avicennias* are able to withstand moderately heavy shade; and there is generally a fair amount of advance growth under cover in the older coupes, and amongst the thickets of *Alchi—Acanthus illicifolius.* This advance growth responds rapidly to full overhead light and forms the chief source of regeneration in the felled coupes. The Avicennias do not coppice, but young stems throw out pollard shoots. In 1910, Mr. A. W. Lushington reported that he had found a large number of pneumatophores producing leaves, remarking: "From the vast number of blind sucker shoots it is evident that such reproduction must be enormous, besides which coppice reproduction is utterly insignificant." In his "Silviculture of Indian Trees" Troup quotes Mr. Lushington as the authority for his remark that the pneumatophores of the Avicennias "ultimately develop leaves and become trees." In fact, the *Avicennias* do not produce regular coppice shoots. Some of the smaller stems

throw out shoots at the cut surface forming a sort of crown coppice, but the vast majority of stumps produce no shoots whatever; and the pneumatophores do not develop leaves and grow into trees. It is probable that Mr. Lushington mistook the numerous browsed down seedlings that are found amongst the pneumatophores for 'blind sucker shoots.' Nothing definite is known of the extent to which one- and two-year old seedlings recover when browsed down; but in areas open to regular browsing the growth persists in the form of low, flat-topped bushes. The *Avicennia* forests cannot be perpetuated in situ; and compared with the duration of the forests of the hinterland they are merely a local phase. Under normal conditions recruitment should be obtained largely from fresh accretions, but the recent surveys of the Coringa reserves showed that fresh accretions formed less than one per cent of the total dry area of the reserves. This is due mainly to the pernicious practice of sweeping the mud flats with bamboos at low tide to collect mud fish, thus destroying all the young seedlings that are endeavouring to establish themselves on these flats. In the felled coupes regeneration is obtainable partly from advance growth and partly from seedlings which drift in after the coupes have been felled. The extent to which each contributes in the formation of the new crop is not definitely known, but it is believed that on the older formations advance growth forms the bulk of the crop. The only climber that is found in the mangrove forests—*Derris uliginosa*—does little damage; and, as the growth appears to thin out naturally, no tending is necessary. The young crops require special protection against browsing.

195. *The Silvicultural System.*—The silvicultural system that best meets the requirements of the growing stock is clear-felling with natural regeneration. This system will be adopted in both sectors.

196. *Rotation.*—In the Coringa sector it is proposed to grow fuel to a mean girth of 12 inches, and in the Kandikuppa sector to a mean girth of 10 inches. The statistics of growth in Part I, Chapter VI show that *Avicennia* crops attain a mean girth of 10 inches in 13 years, and 12 inches in 20 years; and in the same chapter it is pointed out that the figures for crops over 9 years of age should be accepted with caution, as there is some doubt about the ages of the plots that were measured. To be on the safe side, 2 years will be added to the period taken to attain a girth of 10 inches, and 5 years for a girth of 12 inches. In fixing the period to be added for a girth of 12 inches due weight has been given to the economic considerations that will be discussed in the next paragraph. It has therefore been decided that the rotation for the three felling series in the Coringa sector will be 25 years; and for the two felling series in the Kandikuppa Sector the rotation will be 15 years.

197. *Regulation of the yield.*—The yield will be prescribed and regulated by area. In the Coringa sector the labour shortage which has already been discussed in Part I, Chapter IV has a direct bearing on the yield. The maximum strength of the labour force is estimated to be about 200, but it is difficult to raise more than 150 men for work in the mangrove swamps. The economic yield is the quantity of fuel that this labour force can fell and extract during the course of the year. Expressed in area, it has been estimated to be 750 acres per annum excluding blanks. But there is no doubt that, with better organization, it is capable of expansion and for the purposes of the working plan the economic yield has been reckoned to be 820 acres per annum. No matter to what extent the aggregate area of the coupes exceeds this figure, the contractors will pay only for the economic yield; and the revenue obtained from 1,200 acres will be no greater than that obtained from 820 acres. On the other hand, the larger the aggregate area of the coupes, the larger is the area that is left unfelled and the more unsatisfactory is the silvicultural condition of the crop. It has therefore been considered necessary to correlate the economic and cultural yields. It is for this reason that compartments 1 *a*, 1 *b* and 2 b which are easily accessible and easy to protect and where there are fairly large patches of accretionary growth, have been kept out of the working circle and will be specially protected being closed both to grazing and felling. It has also influenced the decision to raise the rotation from 20 to 25 years.

SECTION 6.—METHOD OF EXECUTING THE FELLINGS.

198. *Felling rules for the Coringa sector.*—The following felling rules will apply to the three felling series in the Coringa sector:—

(1) The period of the lease for all coupes will be one year: April 1st to March 31st. No extension may be granted for felling except for special reasons which will be recorded in the remarks column of the control book. However, as it is silviculturally desirable that the ground should be free of all covering refuse when the seed starts drifting, the District Forest Officer may grant an extension for the removal of felled produce and slash until the 30th June on which date all removals from the coupe will cease.

(2) Felling will proceed in regular order through the coupe. The contractor may choose the direction of felling but once felling has started the direction may not be changed without the permission of the District Forest Officer.

(3) The contractor will not fell any growth under 3 inches in girth at the base; and care should be taken that advance growth is damaged as little as possible.

(4) *Tilla*, *Tanduga*, and other species that coppice will be felled within six inches of the ground.

(5) All *Gedara—Ceripos roxburghiana* growing in the coupes is reserved, and may not be felled by the fuel contractor. It is sold separately as minor forest produce for dyeing fishing nets.

(6) On completion of the fellings the contractor will remove all branches and piles of brushwood that may have been placed in the creeks to serve as crossings; and all creeks within the coupe must be left completely free of obstructions likely to impede the free movement of the floating seed or collect silt.

(7) In order to determine the yield with fair accuracy, twelve one-acre plots will be measured in each coupe during the course of the fellings. Ordinarily one plot should be measured every month; and the plot should be truly representative of the locality in which fellings are in progress when the plot is selected. The plots will be selected by the Range offier; they will be felled and the fuel will be stacked by the contractor's coolies and the yield in stacked cubic feet will be measured by the Range officer and the measurements recorded in a measurement book. At the end of the year the mean yield of the twelve plots will represent the yield per acre from the coupe, and the area actually felled multiplied by the yield per acre will be the out-turn of the coupe.

199. *Felling rules for the Kandikuppa sector.*—It is intended that the coupes in the Kandikuppa sector should be worked by the villagers themselves. But this may prove impracticable, and it may be found necessary to supply the local demand through the agency of a contractor, consequently the felling rules have been framed to suit both methods of working. The following rules will apply to both felling series unless otherwise stated:—

(1) The period of the lease for all coupes will be one year: April 1st to March 31st.

(2) No growth may be felled that is not thicker than a man's thumb, at one *moora.*—18 inches—above the ground.

(3) *Tilla*, *Tanduga*, and other species that coppice will be felled within a *bethadu*—a hands breadth—of the ground.

(4) All *Gedara—Ceriops roxburghiana* growing in the coupes is reserved, and must not be felled.

(5) Branches and other refuse must not be thrown into the creeks within the coupe; and before the 31st March the villagers or the contractor will remove all such obstructions from the creeks situated within the coupe.

(6) In order to determine the yield with fair accuracy, four sample plots will be felled and measured in each coupe before it is thrown open to working. The area of each plot will be one acre in the Pandipallam felling series, and half-an-acre in the Pora felling series. The plots must be situated wide apart, and they must be fully representative of the areas in which they are located. The plots will be selected by the Range officer; they will be felled and the produce will be stacked by the villagers or the contractor; and the Range officer will measure the yields in stacked cubic feet recording the figures in a measurement book. The mean yield of the four plots will represent the yield per acre for the coupe; and, at the end of the year, the area actually felled multiplied by the yield per acre will be the outturn of the coupe.

SECTION 7.—TABULAR STATEMENT OF FELLINGS.

200. *Allotment of coupes.*—In the Coringa sector coupes have been definitely allotted only for the period of the working plan, but they have been marked in correct sequence for the whole rotation on the working plan maps; and a statement showing the location and areas of the unallotted coupes will be given separately for each felling series. In the Kandikuppa sector coupes have been allotted for the whole period of the rotation.

Tabular statement of fellings for the Coringa Sector.

Name of felling series.	Year of felling.	Number of coupe.	Compartment in which located.	Mean age of crop at felling.	Area of coupe in acres. Wooded.	Creeks and blanks.	Total.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Coringa	1934–35	I	4	16	261	32	293
	1935–36	II	6 *a*	16	328	11	339
	1936–37	III	9	17	288	16	304
	1937–38	IV	4	16	315	127	442
	1938–39	V	5	21	305	111	416
	1939–40	VI	9	20	311	2	313
	1940–41	VII	8	22	268	109	377
	1941–42	VIII	4	21	284	29	313
	1942–43	IX	6 *b*	22	344	38	382
	1943–44	X	7 *b*	19	302	110	412
Hope Island ..	1934–35	I	14 *b*	..	219	19	238
	1935–36	II	13 *b*, *c*	16	255	21	276
	1936–37	III	14 *a*, *b*, *d*	..	252	10	262
	1937–38	IV	12	18	236	9	245
	1938–39	V	13 *a*	..	184	32	216
	1939–40	VI	11	18	245	..	245
	1940–41	VII	13 *a*	20	211	10	221
	1941–42	VIII	11	20	233	..	233
	1942–43	IX	13 *a*	..	224	21	245
	1943–44	X	..	22	200	5	205
Bhairavapalem ..	1934–35	I	21	..	354	38	392
	1935–36	II	18 *c*	..	254	4	258
	1936–37	III	15 *a*, *b*	..	282	21	303
	1937–38	IV	18 *c*	..	266	..	266
	1938–39	V	20 *a*, *b*, *c*	19	321	13	334
	1939–40	VI	15 *a*	..	270	15	285
	1940–41	VII	20 *c*	20	328	13	341
	1941–42	VIII	18 *b*	..	292	10	302
	1942–43	IX	18 *b*, *c*	..	260	17	277
	1943–44	X	19 *a*	..	314	53	367

Abstract of wooded areas to be felled annually in the Coringa Sector.

Year of felling.	Number of coupe.	Wooded area in acres. Coringa felling series.	Hope Island felling series.	Bhairavapalem felling series.	Total.
(1)	(2)	(3)	(4)	(5)	(6)
1934–35	I	261	219	354	834
1935–36	II	328	255	254	837
1936–37	III	288	252	282	822
1937–38	IV	315	236	266	817
1938–39	V	305	184	321	810
1939–40	VI	311	245	270	826
1940–41	VII	268	211	328	807
1941–42	VIII	284	233	292	809
1942–43	IX	344	224	260	828
1943–44	X	302	200	314	816
				Total area ..	8,206

Unallotted coupes in the Coringa Sector.

A. Coringa felling series.

Number of coupe.	Compartment in which located.	Area in acres.	Number of coupe.	Compartment in which located.	Area in acres.
(1)	(2)	(3)	(1)	(2)	(3)
XI ..	9 ..	331·0	XIX ..	7 *a*, *b* ..	372·0
XII ..	6 *b* ..	382·0	XX ..	9 ..	317·0
XIII ..	8 ..	361·0	XXI ..	8 ..	403·0
XIV ..	6 *a*, *b* ..	297·0	XXII ..	9 ..	262·6
XV ..	7 *a* ..	300·0	XXIII ..	7 *a* ..	325·6
XVI ..	8 ..	400·0	XXIV ..	7 *a* ..	338·0
XVII ..	5 ..	391·0	XXV ..	5 ..	381·0
XVIII ..	6 *b* ..	437·0			

B. Hope Island felling series.

Number of coupe.	Compartment in which located.	Area in acres.	Number of coupe.	Compartment in which located.	Area in acres.
XI ..	12 ..	327·0	XIX ..	10 ..	227·0
XII ..	12 ..	183·0	XX ..	10 ..	240·0
XIII ..	13 *a* ..	248·0	XXI ..	11 ..	420·0
XIV ..	12 ..	243·0	XXII ..	10 ..	251·2
XV ..	11 ..	236·0	XXIII ..	14 *a*, *c* ..	228·0
XVI ..	11 ..	231·0	XXIV ..	14 *a* ..	246·0
XVII ..	13 *a* ..	230·0	XXV ..	14 *a* ..	237·0
XVIII ..	11 ..	264.0			

Unallotted coupes in the Coringa Sector—cont.

C_8 Bhairavapalem felling series.

Number of coupe. (1)	Compartment in which located. (2)	Area in acres. (3)	Number of coupe. (1)	Compartment in which located. (2)	Area in acres. (3)
XI	18 *a*	277·0	XIX	17 *a*, *b*	349·4
XII	18 *a*	301·0	XX	17 *a*, *b*	373·0
XIII	19 *b*	331·0	XXI	16 *a*, *c*	321·0
XIV	19 *b*	340·0	XXII	17 *a*	397·0
XV	21	346·0	XXIII	20 *c*, *h*	381·0
XVI	20 *f*, *g*, *i*, *j*	369·0	XXIV	16 *a*	301·0
XVII	19 *b*, *c*, *d*	357·0	XXV	15 *a*	292·0
XVIII	18 *a*	279·0			

Tabular statement of fellings for the Kandikuppa Sector.

Name of felling series. (1)	Year of felling. (2)	Number of coupe. (3)	Compartment in which located. (4)	Mean age of crop at felling. (5)	Area of coupe in acres. Wooded. (6)	Creeks and blanks. (7)	Total. (8)
Pandipallam	1934–35	I	4, 5	12	177·0	31·0	208·0
	1935–36	II	8	12	179·0	16·0	195·0
	1936–37	III	8	13	178·0	58·0	236·0
	1937–38	IV	4	13	177·0	21·0	198·0
	1938–39	V	4	13	177·0	55·0	232·0
	1939–40	VI	8	14	175·0	52·0	227·0
	1940–41	VII	9 a, 8	15	178·0	65·0	243·0
	1941–42	VIII	9 a, b.	17	178·0	160·0	338·0
	1942–43	IX	6 b. 9 a.	16	178·0	44·0	222·0
	1943–44	X	6 a, b.	16	176·5	27·5	204·0
	1944–45	XI	5, 6 a.	15	177·5	10·5	188·0
	1945–46	XII	5	15	173·0	23·0	196·0
	1946–47	XIII	5	14	179·0	9·0	188·0
	1947–48	XIV	7 a, b,	14	180·0	18·0	198·0
	1948–49	XV	4, 7 a, b.	18	174·0	24·0	198·0
Pora	1934–35	I	7 b.	11	31·0	15·0	46·0
	1935–36	II	7 b.	12	32·0	6·0	38·0
	1936–37	III	7 b.	11	34·5	15·0	49·0
	1937–38	IV	7 b.	14	33·0	39·0	72·0
	1938–39	V	7 c.	13	34·0	21·0	55·0
	1939–40	VI	7 c.	14	35·0	20·0	55·0
	1940–41	VII	7 c.	14	35·0	5·0	40·0
	1941–42	VIII	7 b.	14	32·0	6·0	38·0
	1942–43	IX	7 b.	15	33·0	1·0	34·0
	1943–44	X	7 b.	14	32·0	..	32·0
	1944–45	XI	7 b.	15	32·0	1·5	33·5
	1945–46	XII	7 b.	17	33·5	2·0	35·5
	1946–47	XIII	7 b.	16	33·0	6·5	39·5
	1947–48	XIV	7 b.	16	33·0	9·0	35·0
	1948–49	XV	7 b.	..	..	..	..

SECTION 8.—SUBSIDIARY SILVICULTURAL REGULATIONS.

201. *General.*—Climbers do very little damage in the mangrove forests, and cleaning or thinning is unnecessary. The chief silvicultural requirements are adequate regeneration, and protection of the young crop from browsing. There are three questions connected with the regeneration of the mangrove forests :—

(1) Does *Alchi*—*Acanthus illicifolius* promote or retard regeneration ?
(2) Is it possible to regenerate the large natural blanks artificially ? If it is possible, can it be done at a reasonable cost ?
(3) What measures are necessary to expedite the natural regeneration of the newly formed accretions ?

Each of these questions will be dealt with separately. The protection against browsing will be dealt with under the grazing prescriptions in the next section.

202. *The control of Alchi*—*Acanthus illicifolius.*—It has been recorded that *Alchi* promotes regeneration by protecting the young *mada* seedlings against browsing. There is also a fair amount of evidence to show that it retards regeneration. Our present knowledge does not justify the formulation of prescriptions either for cultural work or for experiments. During the period of this working plan the District Forest Officer will record observations on this subject in the control journal, carrying out experiments if necessary, so that a definite answer to this question will be available at the next revision of the working plan.

203. *The regeneration of the large natural blanks.*—It has been pointed out in Part I, Chapter II, that the soil in these blanks is most unsuitable for artificial regeneration, and the experiments that have been carried out up to date appear to confirm this view. Nevertheless it cannot be affirmed definitely that it is not possible to grow fuel crops on these

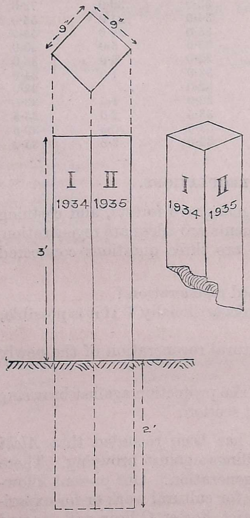
blanks at a reasonable cost, although on broad reasoning this conclusion is fairly evident. As our experiments have not yielded any constructive information it is inadvisable to lay down any definite prescriptions for experimental work in the working plan. But the District Forest Officer in consultation with the Provincial Silviculturist will continue to carry out experiments such as showing Babul seed and planting cuttings of *Thespesia populnea,* in the blanks of the specially protected area situated outside the working circle ; and it is hoped that this question will have been definitely settled before the next revision of the working plan.

204. *Afforestation of the new accretions.*—The accretions in Coringa and Coringa Extension reserves are not being clothed with *Tella mada* as rapidly as one would expect. On investigating the matter it was found the local fishermen are in the habit of sweeping the accretions with bamboos at low tide to trap prawns and mud fish, and that this destroys the seedlings that have taken root on the mud flats. If this practice is stopped the accretions that are above the mean neap high tide will probably be soon covered with *Tella mada.* This matter needs early investigation, and the District Forest Officer will carry out the following experiment. He will select three plots, each about ten acres in extent on accretionary flats that are above the mean neap high tide level. One plot will be in the Hope Island felling series, one in the Coringa felling series and the third in the specially protected area. A line of stout stakes will be planted about 100 yards from the nearest fringe of growth, enclosing the plots. This work will be done before September 1st 1934. The plots will then be closed to fishing and the collection of shells. If the closure results in the plots being covered with *Tella mada,* immediate steps will be taken to extend the areas closed to fishing in consultation with the Collector and the Conservator.

SECTION 9.—OTHER REGULATIONS.

205. *Survey and demarcation of the coupes.*—The following rules will be observed :—

(1) The coupes to be felled in the ensuing year will be surveyed and demarcated before the 15th February. All cut lines will be 11 feet wide. The demarcation will present no difficulty as the coupes have been so arranged that all lines run due north or due east, and the average coupe will be demarcated by cutting only one, or sometimes two lines. The survey of the coupes will be on a scale of 8 inches = 1 mile and, since the minor creeks have not been shown on the working plan maps, all creeks in the coupes up which a boat can be taken will be surveyed and marked on the coupe maps.



(2) In April the unfelled portions of the coupes of the previous year will be surveyed and coupe stones will be erected at all corners of the coupes. As the local stand-stone weathers badly in the mangrove swamps, the stones will be cut from the hard granite obtainable at Rajahmundry from which place there is cheap water transport to Coringa and Kandikuppa. Coupe stones of the standard size and pattern are unsuitable for use in the mangrove swamps ; while teakwood posts and boards are stolen by the fishermen for oar blades and other purposes. Coupe stones 9 inches square and 5 feet long will be tried. They will be buried 2 feet in the clay leaving 3 feet projecting above ground level. (See sketch.) If they prove unsuitable the District Forest Officer will try other forms of coupe stones.

(3) The coupe lines will be maintained for five years after felling : this corresponds with the period of closure to grazing. Thereafter it will not be necessary to maintain the coupe lines.

206. *General remarks on grazing.*—As the grazing conditions in the Coringa and Kandikuppa Sectors differ greatly, separate regulations will be framed for each sector.

207. *Grazing regulations for the Coringa Sector.*—Although it is desirable that the Coringa Sector should be completely closed to grazing, it is not practicable ; and an effective compromise seems to be the only solution to the grazing problem. The lines of approach are clear : The neighbouring villagers need grazing accommodation chiefly from July

1st to December 31st when the crops are in the ground. During the rest of the year they are able to accommodate their cattle in their own fields. From July to December there is a fair amount of grass in the blanks and along the margins of the creeks, and grazing does less damage to the forests at this time of the year than in the dry weather when buffaloes feed chiefly or the principal species. Consequently grazing should be provided from July to December, when it is most wanted; and the forests should be closed to grazing from January to June, when protection is most needed. The working circle will therefore be open to grazing from July 1st to December 31st and closed to grazing during the rest of the year. All coupes will be closed to grazing for five years after felling. As buffaloes swim the creeks and roam unattended throughout the mangrove swamps, it is undoubtedly difficult to enforce the closure of the young coupes. Nevertheless the prescription is necessary and must be enforced, for if there were no such prescription herds of buffaloes would settle down in the coupes and destroy the regeneration. Other details connected with grazing will be found in the chapter on the Grazing Working Circle.

208. *Grazing regulations for the Kandikuppa Sector.*—The whole of the Kandikuppa Sector will be permanently closed to grazing. As there are extensive grazing grounds within the reserve this will cause no hardship or inconvenience.

209. *Removal of dead wood.*—The fishermen using the creeks of Coringa and Coringa Extension reserves will be permitted to collect dry fuel from the felled coupes and elsewhere on payment of a fee of Re. 1 per boat for a period of four months. On no account will the felling of green fuel be permitted; and the fishermen will not be allowed to carry knives within the reserves. All removals of green fuel will be treated as thefts. The protective staff will keep a close watch on these removals, and if the concession is abused it will be withdrawn immediately and the fishermen will then have to purchase their requirements from the coupe contractors. The removal of dry fuel in Coringa reserve has been permitted because this concession has been in force for a long time, and the administrative staff consider it undesirable to abolish it completely. The area of the Coringa reserves is large; there are no fishing villages situated within the reserve; and the demand for fuel from the villages on the border of the reserve is not heavy, and is met largely from Zemindari forests. Nevertheless, the unregulated removal of dry wood is unsatisfactory, and it must be carefully controlled. As the mangrove forests of Kandikuppa reserve are to be worked solely to meet the local demand, no removals of dead wood will be permitted in the Kandikuppa Sector.

210. *Maintenance of the water-ways.*—Provision has been made in Chapter XII for deepening some of the more important creeks.

SECTION 10.—CONTROL.

211. *General remarks.*—The main purpose of control is to ensure that the prescriptions of the working plan are adhered to. Nevertheless it is desirable that advantage should be taken of the control arrangements to collect accurate figures of yield, and to watch the progress of regeneration in the felled coupes. At present the yields reported from the Coringa and Kandikuppa coupes are most inaccurate; and at the annual sales the only basis for negotiation is the prices paid in past years, and these prices bear no relationship whatever to the recorded yields. The progress of regeneration is reported in vague terms such as 'satisfactory,' 'fair,' 'promising,' etc., which have no definite meaning; and it is necessary to maintain a record which will show the progress of regeneration at a glance. Provision will be made in the control book for the collection of accurate figures of yield; and a regeneration map will be maintained to show the progress of regeneration. The following control records will be maintained :—

(1) The Control Book.
(2) The Record of Works.
(3) The Control Journal.
(4) The Control and Regeneration Map.

In addition to these records an annual summary of revenue and expenditure will be maintained as a consolidated record for all the working circles.

212. *The Control Book.*—A sample form of the control book is given in Appendix VIII. The yield per acre in column 13 will be posted from the measurement books referred to in paragraphs 198 (7) and 199 (6) and the total outturn in column 14 is obtained by multiplying the wooded area actually felled shown in column 10 by the yield per acre shown in column 13.

213. *The Record of Works and the Control Journal.*—These will be maintained in the usual manner. A sample form of the record of works is given in Appendix VIII.

214. *The Control and Regeneration Map.*—The control and regeneration map will be maintained on a scale of 4 inches = 1 mile, a spare copy of the working plan map being used for this purpose. The map will be maintained in the usual manner, and the minor creeks

surveyed under the prescriptions of paragraph 205 (1) will be posted on the control and regeneration map. Five years after a coupe has been felled—that is just before the maintenance of the coupe lines is abandoned and the coupe thrown open to grazing—the Range Officer will make a careful inspection of the coupe to take stock of the regeneration. In doing so he will mark the areas that have been regenerated on the working plan map as accurately as possible, and he will record notes on the regeneration of the coupe. The District Forest Officer, or a gazetted assistant will check the regeneration sketch and notes submitted by the Range Officer, and the sketch will then be posted on the regeneration maps, while any useful facts recorded in the Ranger's notes will be posted in the control journal. The special purpose of this prescription is to ensure that regeneration receives adequate attention : there must be no felling and forgetting.

CHAPTER III.—WORKING PLAN FOR THE MANGROVE COPPICE WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION OF THE WORKING CIRCLE AND CHARACTER OF THE VEGETATION.

215. *Constitution of the working circle.*—The working circle includes all the mangrove forests that can be regenerated by simple coppice. It is confined to the Upputeru reserve of the West Godavari district, where *Tilla—Excoecaria agallocha, Thanduga—Lumnitzera racemosa*, and other species that coppice, form 90 per cent of the growing-stock. The working circle covers the whole of the Upputeru reserve situated east of the Dongapandi river, and compartment 1 to the west of the Dongapandi. The remainder of the reserve, which contains very little growth, will be managed for grazing ; and probably part of it will be taken up for paddy cultivation during the period of the working plan.

216. *General character of the vegetation.*—Only 38 per cent of the area included in the working circle is wooded ; the rest is blank. The wooded areas are situated chiefly on the banks of the main creeks, in belts of varying width with irregularly incised outer margins. The Upputeru swamps have passed beyond the formative stage, and the *mada* phase of growth : there are some old hollow *Nalla-mada* trees along the banks of the Dongapandi and the Kotachedu ; there are some small patches of *Tella-mada* on the low-lying flats ; and part of the left bank of the Upputeru is fringed with large *Uppu-ponna—Rhizophora mucronata* ; but everywhere else *Tilla* and *Thanduga* predominate. *Tilla* is most plentiful on the margins of the creeks but elsewhere *Thanduga* is the principal species. It forms pure crops in the northern half of the working circle, and appears to be invading the blanks. The associate species are *Guggilam—Aegiceras corniculatum, Gangaravi—Thespesia populnea* and *Parivili—Tamarix gallica* : all three species coppice freely. The entire area has been worked as simple coppice and the growth in the old coupes is generally even-aged and regular.

SECTION 2.—PERMANENT DIVISION INTO BLOCKS AND COMPARTMENTS.

217. *Division into blocks.*—The Upputeru reserve has been divided into two blocks :—

(1) The Dongapandi block, situated west of the right bank of the Dongapandi, and
(2) the Losari block, situated east of the right bank of the Dongapandi.

The working circle includes the whole of the Losari block, and compartment 1 of the Dongapandi block.

218. *Subdivision into compartments.*—The Upputeru reserve has been sub-divided into eight compartments—four in each block. Except for two or three cut lines all the boundaries of the compartments are well-marked natural features. The compartments have been formed chiefly for location purposes ; and further division into sub-compartments is unnecessary.

DISTRIBUTION AND AREA STATEMENT FOR THE MANGROVE COPPICE WORKING CIRCLE.

Name of block.	Number of compartment.	Area of compartment (acres).			Remarks.
		Wooded.	Blanks and creeks.	Total.	
(1)	(2)	(3)	(4)	(5)	(6)
Dongapandi	1	575	471	1,046	Compartments (3), (4) and (5) are in the Grazing Working Circle.
Losari	5	453	941	1,394	
	6	758	1,151	1,909	
	7	387	683	1,070	
	8	497	210	707	
	Total area ..	2,670	3,456	6,126	

SECTION 3.—SUBDIVISION OF THE WORKING CIRCLE.

219. *Felling series and reasons for their formation.*—The special object of this working circle is to supply the neighbouring villages with fuel for domestic purposes and for smoking fish; and it is necessary that the coupes should be situated within easy reach of these villages. If several villages had to obtain their supplies from a common coupe, dissensions would probably arise. It has therefore been decided to divide the working circle into three felling series :—

	ACS.
(1) The Dongapandi felling series	2,440
(2) The Kottapusalamuri felling series	1,909
(3) The Losari felling series	1,777
Total area ..	6,126

SECTION 4.—ANALYSIS AND VALUATION OF THE CROP.

220. *Analysis of the crop.*—The working circle will be managed solely for the production of fuel, and the only analysis that was necessary was :—

(1) to determine the areas that are blank and wooded in each compartment so that it would be possible to lay out approximately equi-productive coupes, and

(2) to determine the age-gradations of the growing stock so that the coupes could be arranged in proper sequence.

As the Madras Survey map of Upputeru reserve was found to be inaccurate, the reserve was surveyed on a scale of 4 inches=1 mile, and advantage was taken of the survey to mark all the wooded areas on the map. The areas that are blank and wooded in each compartment were computed from these maps; and the age gradations were obtained from the old working plan maps and checked on the ground.

221. *Valuation of the crop.*—The valuation of the crop has not been attempted for want of reliable data.

SECTION 5.—METHOD OF TREATMENT.

222. *Silviculture of the principal species.*—*Thanduga* and *Tilla* are the principal species; the area covered by the two species being in a ratio of about 6 to 4. *Thanduga* appears to dislike saline soils and grows at its best on the margins of the blanks where the swamp water is only slightly saline. It has a superficial root system and knee-roots which serve as breathers; and it appears to grow best on soils in which there is a small admixture of sand with clay. *Tilla* grows best on stiff heavy clay on the margins of salt-water creeks, and has a deep root system. The two species mix freely on intermediate soils. Both *Thanduga* and *Tilla* coppice well, the former producing fewer shoots and straighter stems than the latter. The average of 600 stools, of ages ranging from 2 to 12 years, was found to be 2 to 3 shoots for *Thanduga*, and 5 to 6 shoots for *Tilla*. The height growth of the coppice shoots is more or less the same for both species, and in mixed crops one does not dominate the other. Very little is known of the natural regeneration of the two species. Both seed profusely and germinate readily but very little natural regeneration appears to survive, and the coupes are regenerated mainly by coppice. The subsidiary species are amenable to the same treatment as the principal species.

223. *The silvicultural system.*—The silvicultural system will be Simple Coppice.

224. *Rotation.*—The object of management is to grow fuel to a mean girth of 10 inches. The statistics of growth in Part I, Chapter VI show that mixed crops of *Thanduga* and *Tilla* attain a girth of 10 inches in 13 years. Two years will be added as a margin of safety; and the rotation for all three felling series will be 15 years.

225. *Regulation of the yield.*—The yield will be prescribed and regulated by area.

SECTION 6.—METHOD OF EXECUTING THE FELLINGS.

226. *General remarks.*—It is intended that the coupes in all three felling series should be worked by the villagers themselves. But this may prove impracticable and it may be found necessary to supply the local demand through the agency of a contractor; consequently the felling rules have been framed to suit both methods of working.

227. *The felling rules.*—The following felling rules will be observed :—

(1) The period of lease for all coupes will be one year : April 1st to March 31st.

(2) No growth may be felled that is not thicker than a man's thumb at one *moora*—18 inches—above ground level.

(3) All trees and shrubs will be felled within a *bethadu*—a hands-breadth—of the ground.

(4) It is unnecessary to retain old *mada* and *Kalinga* trees: they may be felled.

(5) Branches and other refuse must not be thrown into the creeks; and before the 31st March the villagers or the contractor will remove all such obstructions from the creeks situated within the coupe.

(6) In order to determine the yield with fair accuracy, four sample plots will be felled and measured in each coupe before it is thrown open to working. The area of each plot will be one acre. The plots must be situated wide-apart, and they should be truly representative of the areas in which they are located. The plots will be selected by the Range Officer; they will be felled, and the produce will be stacked, by the villagers or the contractor; and the Range Officer will measure the yields in stacked cubic feet recording the measurements in a measurement book. The mean yield of the four plots will represent the yield per acre for the coupe; and, at the end of the year, the area actually felled multiplied by the yield per acre will be the out-turn of the coupe.

SECTION 7.—TABULAR STATEMENT OF FELLINGS.

228. *Allotment of coupes.*—Coupes have been allotted for the whole rotation in all three felling series.

TABULAR STATEMENT OF FELLINGS.

Name of felling series.	Year of felling.	Number of coupe.	Compartment in which located.	Mean age of crop at felling.	Area of coupe in acres.		
					Wooded.	Creeks and blanks.	Total.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dongapandi ..	1934–35.	I	1	13	63	6	69
	1935–36.	II	1	14	62	..	62
	1936–37.	III	1	14	62	4	66
	1937–38.	IV	5	14	71	14	85
	1938–39.	V	5	14	75	107	182
	1939–40.	VI	5	15	77	301	378
	1940–41.	VII	1	16	63	34	97
	1941–42.	VIII	1	17	64	51	115
	1942 43.	IX	5	17	79	248	327
	1943–44.	X	1	17	62	38	100
	1944–45.	XI	1	17	66	85	151
	1945–46.	XII	1	15	66	216	282
	1946–47.	XIII	1	15	67	37	104
	1947–48.	XIV	5	16	73	161	234
	1948–49.	XV	5	17	78	110	188
Kottapusalamuri ..	1934–35.	I	6	12	44	88	132
	1935–36.	II	6	12	47	41	88
	1936–37.	III	6	11	51	7	58
	1937–38.	IV	6	11	45	151	196
	1938–39.	V	6	12	53	67	120
	1939–40.	VI	6	13	52	73	125
	1940–41.	VII	6	3	51	50	101
	1941–42.	VIII	6	4	52	43	95
	1942–43.	IX	6	13	57	282	339
	1943–44.	X	6	12	47	131	178
	1944–45.	XI	6	13	51	50	101
	1945–46.	XII	6	14	54	33	87
	1946–47.	XIII	6	15	52	24	76
	1947–48.	XIV	6	15	49	19	68
	1948–49.	XV	6	16	53	92	145
Losari	1934–35.	I	7	13	64	216	280
	1935–36.	II	7	13	60	90	120
	1936–37.	III	7	14	66	35	101
	1937–38.	IV	8	14	59	2	61
	1938–39.	V	8	15	55	8	63
	1939–40.	VI	8	16	57	..	57
	1940–41.	VII	8	17	54	1	55
	1941–42.	VIII	8	17	55	2	57
	1942–43.	IX	8	18	53	3	56
	1943–44.	X	8	19	56	3	59
	1944–45.	XI	8	19	56	12	68
	1945–46.	XII	8	20	52	179	231
	1946–47.	XIII	7	18	67	129	196
	1947–48.	XIV	7	16	62	115	177
	1948–49.	XV	7	15	68	98	166

ABSTRACT OF WOODED AREAS TO BE FELLED ANNUALLY IN THE MANGROVE COPPICE WORKING CIRCLE.

Year of felling.	Number of coupe.	Wooded area in acres.			
		Donga-pandi felling series.	Kottapu-salamuri felling series.	Losari felling series.	Total.
(1)	(2)	(3)	(4)	(5)	(6)
1934–35	I	63	44	64	171
1935–36	II	62	47	60	169
1936–37	III	62	51	66	179
1937–38	IV	71	45	59	175
1938–39	V	75	53	55	183
1939–40	VI	77	52	57	186
1940–41	VII	63	51	54	168
1941–42	VIII	64	52	55	171
1942–43	IX	79	57	53	189
1943–44	X	62	47	56	165
1944–45	XI	66	51	56	173
1945–46	XII	66	54	52	172
1946–47	XIII	67	52	67	186
1947–48	XIV	73	49	62	184
1948–49	XV	78	53	68	199
				Total area ..	2,670

SECTION 8.—SUBSIDIARY SILVICULTURAL REGULATIONS.

229. *General remarks.*—Climbers do very little damage to the growing stock; and neither cleaning nor thinning is necessary. The chief silvilcultural requirements are natural or artificial regeneration to replenish the growing stock in the felled coupes, and protection against damage by men or cattle. Protection will be dealt with in the next paragraph.

230. *Replenishment of the growing stock in the felled coupes.*—Although the two principal species seed profusely and germinate readily, most of the seedlings die, and very little natural regeneration is established. Nothing definite is known of the reproduction of *Thanduga* and *Tilla* from seed. No observations have been recorded on the natural regeneration of these two species, and all attempts at artificial regeneration have failed, yielding no constructive information. It may be that the ground has passed beyond the *Thanduga—Tilla* phase, and that the failure of regeneration is natural; and, as the growing stock is so poor and of such little value, artificial replenishment of the felled coupes will probably cost more than it is worth. The most promising artificial measures appear to be broadcast sowing of *Acacia arabica* in patches the year after felling, and planting cuttings of *Thespesia populnea* shortly after the rains, as soon as the ground is free of standing water. However, our knowledge does not warrant the formulation of definite prescriptions for replenishing the growing stock in the felled coupes, and it will be left to the District Forest Officer to find a solution to the problem. The observations on natural regeneration recorded in the control journal will be directed towards explaining why natural regeneration is scarce when the principal species seed profusely and germinate readily; and the District Forest Officer will carry out experiments in the felled coupes to ascertain whether the growing stock can be replenished artificially at a reasonable cost considering the prices for which the coupes are sold. *Babul*, *Tamarix* and *Thespesia populnea* may be tried; and the Provincial Silviculturist should be consulted before the District Forest Officer embarks on these experiments. It is hoped that these questions will be answered definitely before the next revision of the working plan.

SECTION 9.—OTHER REGULATIONS.

231. *Survey and demarcation of the coupes.*—The following rules will be observed :—

(1) The coupes to be felled in the ensuing year will be surveyed and demarcated before the 15th February. All cut lines will be 10 feet wide. The demarcation will present no difficulty as the coupes have been so arranged that all cut lines run due north or due east, and most of the coupes will be demarcated by cutting only one line. The coupes will be surveyed on a scale of 8″=1 mile.

(2) The unfelled portions of the coupes of the previous year will be surveyed in April, and coupe stones of hard granite, and of the standard pattern, will be erected at all four corners of the coupes.

(3) The coupe lines will be maintained for five years after felling: this corresponds with the period of closure to grazing. Thereafter it will not be necessary to maintain the coupe lines.

232. *Grazing regulations.*—At present the entire area is open to grazing: even the young coupes. The current working plan explains this as follows: "Hitherto the coupe under working and the previous coupe were prescribed to be closed to grazing. This prescription remains a dead letter, and there appears to be no meaning in prescribing this, when it could not be enforced, as the cattle are semi wild; and when no damage is done to the growth as they do not browse the leaves of *Thanduga* and *Tilla* which form the chief growth on the area. There are also sufficient grassy blanks to afford grazing throughout the year. It should be admitted that trampling over the area under regeneration might result in damaging a few seedlings, here and there, but since the regeneration is mostly dependant on coppice, according to the scheme, there is no harm in sacrificing a certain amount of small seedlings to avoid friction with the villagers." It has already been pointed out that the chief silvicultural need is seedling regeneration to replace the coppice stools, and protection of the young coupes from damage by cattle. In the chapter on the legal position in the current working plan it is remarked that the reserve is "free of all encumbrances." Yet the whole of the Upputeru reserve is one big fishing ground; the depleted growing stock is raided by the fisherfolk and the neighbouring villagers; and finally we abandon the protection of the young coupes against damage by cattle "to avoid friction with the villagers." This sheering of the administration along the lines of least resistance does infinite harm. If the working circle is to be managed for the production of fuel other considerations must give way to the main object of management; and if the other considerations predominate, it is better to change the object of management than to limp along on half measures. In the Mangrove Coppice Working Circle there are no such considerations and the following grazing regulations will be enforced:—

(1) Compartments 2, 3, and 4 of Upputeru reserve which are outside the working circle will be thrown open to grazing without let or hindrance. The aggregate area of these compartments is 4,700 acres, constituting 43 per cent of the total area of the reserve and 63 per cent of the grazing grounds. Cattle may graze in these compartments unaccompanied by a grazier in accordance with the present practice.

(2) All cattle grazing within the Mangrove Coppice Working Circle must be accompanied by a grazier.

(3) Coupes will be closed to grazing for five years after felling.

(4) The following eight coupes, which will be closed to grazing during the period of the working plan, contain large blanks in which grazing will do no harm; and as the coupes adjoin village lands, complete closure will cause inconvenience to the adjoining villages. In these eight coupes a closure line will be demarcated a hundred yards from the edge of the forest, and the large blanks adjoining the village lands will remain open to grazing.

Dongapandi felling series	Coupes VI and IX.
Kottapusalamuri felling series	Coupes IV, VI, VII, VIII and IX.
Losari felling series	Coupe I.

233. *Fishing in the creeks and blanks.*—At present the fishermen of Dongapandi enclosure, and the adjoining villages are permitted to net the main creeks at fixed places known as *katlus*, on payment of a fee of Rs. 5 per *katlu* per annum; and to trap prawns and fish on the blanks, when they are under water, in basket-traps known as *garlu* on payment of a fee of one anna per *garlu* per annum. As fishing throughout the reserve is now an established practice it will be allowed to continue at the same rates, but the District Forest Officer will use the fishing concessions to enforce protection of the growing stock. As the fishermen derive considerable benefits from these fishing concessions and have free access to all parts of the reserve, it is reasonable to hold them responsible for all illicit fellings and to bring home their responsibility to them by regulating the fishing fees according to the state of protection. The poisoning of fish with *Tilla* juice or any other fish poison is prohibited throughout the reserve.

234. *Removal of dead wood.*—All supplies of fuel must be obtained from the coupe of the year. No unregulated removals of dead wood will be permitted.

SECTION 10.—CONTROL.

235. The following control records will be maintained:—

(1) The Control Book.
(2) The Record of Works.
(3) The Control Journal.
(4) The Control Map.

These records will be maintained in the same manner as was prescribed for the Mangrove Clear-felling Working Circle, except that there will be no surveys of minor creeks to be entered on the control map. Sample forms of the Control Book and the Record of Works will be found in Appendix VIII.

CHAPTER IV.—WORKING PLAN FOR THE CASUARINA PLANTATION WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION OF THE CIRCLE AND CHARACTER OF THE VEGETATION.

236. *Constitution of the working circle.*—Compartment 12 and sub-compartment 13-*a* of Kandikuppa block together constitute the working circle. Compartment 12 is a long narrow strip of land 4¼ miles in length with a mean width of about 500 yards. It is composed mainly of the Casuarina plantation, but includes the sandy beach lying between the Casuarina plantation and the Bay of Bengal, two low-lying strips of land where Casuarina will not grow, and the enclosures containing the drinking-water wells used by the fisher folk of Kothapalem and Pora. Sub-compartment 13-*a* is situated about a mile and a half to the south-west of compartment 12, the intervening ground being private property. It contains 17 acres of Casuarina and six acres of land suitable for planting Casuarina. As this small plantation is isolated and adjoins a private plantation it is difficult to protect. The Zamindar whose lands adjoin sub-compartment 13-*a*, owns a plantation, 15·3 acres in area, continuous with the western end of compartment 12 ; and about 7·7 acres of his land adjoining this plantation are suitable for planting Casuarina, the two together forming a regular plot of 23 acres. It is recommended that the Forest Department should acquire this plot, and hand over the 23 acres of compartment 13-*a* in part exchange. When this has been effected the Government and Zemindari plantations will form compact blocks separated by about a mile, and the acquired plot will be added to compartment 12.

237. *Character of the vegetation.*—When this working plan comes into force the current planting scheme will be complete, and the growing-stock will consist of a series of Casuarina plantations ranging in age from one to ten years, with a small plot eleven years old which has been reserved for seed. The plantations that are over five years old will have been pruned and thinned ; the plantations that are four and five years old will have been pruned ; and coupe I, planted in 1924, will be ready for felling. There are two low-lying strips of land, at the south-east end of the plantation, which are water-logged during the rains and where Casuarina will not grow ; and there are some low sand dunes, at the south-west end of the plantation, which have not been planted with Casuarina. The rest of the plantation is more or less fully stocked. The quality of the crop varies with the elevation which differs by about four feet in different parts of the plantation. The generel slope is south to north. The ground along the northern edge of the plantation is low-lying and water-logged in parts during the rains, and the growth is poor. The crop improves southwards with the rise of the ground ; it attains its best in the southern half of the plantation, and declines again towards the seaboard edge where the last few rows of trees are frequently whipped by strong winds. The only other species found in the plantation are the shrubs *Calatropis gigantea* and *Cassia auriculata* which are found in the blanks, and the climber *Leptodenia reticulata* which occurs sporadically throughout the plantation and does considerable damage if allowed to grow unchecked. The common sand-binding plants, *Ipomoea pes-caprae* and *Spinifex squarrosus*, are found on the dunes, and on the sand bordering the southern edge of the plantation.

SECTION 2.—SUBDIVISION OF THE WORKING CIRCLE.

238. *General remarks.*—The total area of the working circle is 937 acres—914 acres in compartment 12, and 23 acres in sub-compartment 13-*a*, both of Kandikuppa block. Compartment 12 is uncommonly large, and it should ordinarily have been divided into several compartments. However, as it is in keeping with the other compartments of the Kandikuppa block, and as the units for controlling both felling and planting will be 10-acre sections, it is unnecessary to form smaller compartments at present. At the next revision of the working plan when the 10-acre sections will have been established, they may be grouped to form smaller compartments.

239. *Division into sub-compartments.*—Compartment 12 contains several areas which will not be planted with Casuarina, and for general convenience it has been divided into seven sub-compartments as shown in the following area statement :—

Compartment. (1)	Sub-compartment. (2)	Description. (3)	Area in acres. (4)
12	12 a	The area planted with Casuarina east of the Pora well enclosure, and the strip along which it is proposed to extend the plantation.	644·5
	12 b	The larger blank that is water-logged during the rains	47·5
	12 c	The smaller blank that is water-logged during the rains	3·5
	12 d	The beach	95·5
	12 e	The Pora well enclosure, including 2 acres of Casuarina to be retained as a building site.	4·5
	12 f	The inspection shed and the Kothapalem well enclosure	8·0
	12 g	The area planted with Casuarina west of the Pora well enclosure, and the strip along which it is proposed to extend the plantation.	110·5
	13 h	The isolated plantation, and the area by which it can be extended ..	23·0
		Total area of the working circle ..	937·0

The total area to be planted with Casuarina will be 778 acres ; sub-compartments 12-*d*, 12-*e* and 12-*f*, aggregating 108 acres, are unproductive ; and an attempt will be made to stock compartments 12-*b* and 12-*c* with other species.

240. *Planting sections.*—To facilitate location, and for the purpose of organizing and controlling felling, planting and tending, the 778 acres to be planted with Casuarina have been divided into 80 sections. The sections have been marked on the 8-inch working plan map. As the boundaries of the Casuarina plantation are somewhat irregular, and as it is necessary that each coupe should contain a number of complete sections, it has not been possible to make all the sections uniform in area. There are 63 ten-acre sections, and 17 sections of areas ranging from 4·7 to 13·3 acres. The following statement shows the distribution and area of the sections :—

Sub-compartment.	Section.	Area in acres.	Sub-compartment.	Section.	Area in acres.
(1)	(2)	(3)	(1)	(2)	(3)
12 G	1	10·0	12 A	41	10·0
,,	2	10·0	,,	42	10·0
,,	3	10·0	,,	43	10·0
,,	4	10·0	,,	44	5·0
,,	5	10·0	,,	45	10·0
,,	6	8·0	,,	46	10·0
,,	7	10·0	,,	47	8·0
,,	8	10·0	,,	48	10·0
,,	9	12·5	,,	49	10·0
,,	10	10·0	,,	50	10·0
,,	11	10·0	,,	51	10·0
12 A	12	10·0	,,	52	10·0
,,	13	10·0	,,	53	10·0
,,	14	10·0	,,	54	10·0
,,	15	10·0	,,	55	8·4
,,	16	5·5	,,	56	10·0
,,	17	10·0	,,	57	10·0
,,	18	10·0	,,	58	10·0
,,	19	10·0	,,	59	10·0
,,	20	10·0	,,	60	10·0
,,	21	10·0	,,	61	10·0
,,	22	10·0	,,	62	9·6
,,	23	8·0	,,	63	10·0
,,	24	10·0	,,	64	10·0
,,	25	10·0	,,	65	10·0
,,	26	10·0	,,	66	10·0
,,	27	10·0	,,	67	4·7
,,	28	10·0	,,	68	10·0
,,	29	10·0	,,	69	10·0
,,	30	10·0	,,	70	13·3
,,	31	8·0	,,	71	7·5
,,	32	10·0	,,	72	10·0
,,	33	10·0	,,	73	10·0
,,	34	10·0	,,	74	10·0
,,	35	10·0	,,	75	7·5
,,	36	8·0	,,	76	11·7
,,	37	10·0	,,	77	10·0
,,	38	10·0	,,	78	9·3
,,	39	10·0	13 A	79	10·0
,,	40	10·0	,,	80	13·0

241. *Felling series.*—There will be only one felling series : the Casuarina felling series, with an area of 778 acres. It includes sub-compartments 12-*a*, 12-*g*, and 13-*a*. If the 23-acre plot adjoining sub-compartment 12-*g* is acquired, it will be added to the felling series, and sub-compartment 13-*a* will be excluded. This will make no difference in the aggregate area of the felling series. Sub-compartments 12-*b* and 12-*c* being unsuitable for Casuarina have been kept out of the felling series, and an attempt will be made to plant them with other species. As the area of the two sub-compartments is only 51 acres, and as the planting scheme is largely experimental, they will not form a separate series. The low-lying ground which forms these two sub-compartments will be referred to as the Sacramento ditch. Sub-compartments 12-*d*, 12-*e* and 12-*f* are unproductive, but have been included in the working circle for general convenience.

SECTION 3.—ANALYSIS AND VALUATION OF THE CROP.

242. *Analysis of the crop.*—The crop is pure Casuarina. The height growth varies in different parts of the plantation but on the whole it is fairly uniform. No attempt has been made to divide the plantation into quality classes, because the oldest plantation is still immature, and for yield tables and other purposes it is desirable that the quality classes for Casuarina should be standardized throughout the Madras Presidency. Five one-acre sample plots in best quality crops were analysed and the data obtained from the five plots was averaged and corrected for an espacement of 7 feet by 7 feet with the following results :—

One-acre type plot (thinned)—Kandikuppa best quality mean age—7 years.

(*a*) Espacement	7 feet by 7 feet.
(*b*) Number of planting spaces	900
(*c*) Number of suppressed stems in crop	24 or 3 per cent.
(*d*) Number of dead stems in crop	18 or 2 per cent.
(*e*) Number of planting spaces occupied by water-holes	36 or 4 per cent.
(*f*) Number of stems removed in thinning	238 or 26 per cent.
(*g*) Casualties from date of planting	217 or 24 per cent.
(*h*) Number of active stems in final crop	367 or 41 per cent.

Note.—On an average there are three water-holes per acre.

Measurements recorded in a one-acre plot of best quality, ten years old showed a mean diameter of 6·2 inches and a mean height of 68 feet. The entire working circle was re-surveyed on a scale of 8 inches to a mile, and all areas have been computed from this survey.

243. *Valuation of the crop.*—No attempt has been made to assess the capital value of the plantation, chiefly because of the difficulty in determining the rate of interest at which an income derived from a Casuarina plantation could be capitalized at the present time. The rate of interest for agricultural loans affords no criterion because the land on which the plantation stands is of little value and the perishable growing-stock is the main security, whereas for agricultural loans the land is the chief security. If the current rate of interest on Government loans, or one per cent above this rate were adopted, it would inevitably result in over-valuation ; and a purely arbitrary valuation serves no useful purpose. All necessary information regarding the financial position of the Casuarina plantation will be found at the end of this chapter.

SECTION 4.—METHOD OF TREATMENT.

244. *Silviculture of the principal species.*—*Casuarina equisetifolia* is a fast growing species and a strong light demander. It is easily suppressed. It has a rather shallow root-system and is susceptible to both water-logging and drought. In the plantations numerous casualties from drought have been traced to the bending of the tap-root at the time of planting. Casuarina grows best on fine sand or on sand with a light admixture of alluvial silt. It will not thrive on heavy soils and suffers from drought on coarse sands. It flowers and seeds twice a year : in March-April and October-November. There is a local belief that the seed collected at the second seeding is more fertile than that collected earlier in the year, but the increased fertility is probably due to the fact that as the seed is sown in January it is fresher if collected in November and therefore gives better results. In the plantations of the Lower Godavari division natural regeneration is rare and Casuarina does not coppice. Artificial regeneration presents no difficulty, and Casuarina is raised chiefly by planting. When grown in the open it produces powerful side branches, and even in the plantation the small branches persist and have to be pruned. Casuarina being an intense light demander needs early and fairly heavy thinning when planted in close formation. The injuries to which the crop is liable have been described in Chapter II of Part I.

245. *Silvicultural system.*—The silvicultural system will be clear-felling and planting.

246. *Rotation.*—In the current felling scheme the rotation is ten years. The correct rotation for a Casuarina plantation is the age at which the mean annual increment culminates. This is the rotation of the greatest volume production ; and as the price per volume unit is constant it is also the financial rotation. Measurements recorded in the Kandikuppa plantation show that the current annual increment is still rising at ten years, consequently the mean annual increment would culminate several years later. But these figures are vitiated by the fact that the quality of the plantations aged 7 to 10 years is very uneven, and the oldest plantation, a 15-acre plot planted in 1923 is of markedly better quality than the plantation that is 9 years old. The correct rotation is probably between twelve and fifteen years. This will be investigated during the period of this plan in the manner prescribed in paragraph 263. Meanwhile as we are unable to determine the

approximate age at which the mean annual increment culminates, and as the present rotation has proved highly remunerative, no change will be made, and the rotation adopted for the Casuarina felling series will be ten years.

247. *Regulation of the yield.*—The yield will be prescribed and regulated by area.

SECTION 5.—METHOD OF EXECUTING THE FELLINGS.

248. *Felling agency.*—For the first three years the fellings will be executed departmentally for the following reasons :—

(*a*) It is necessary that the work should be properly organized so that, all felling and stacking will be complete before the rains set in, all stumps will be extracted during the rains, and the soil will be exposed to sun and air for as long a period as possible before re-planting.

(*b*) It is necessary that the produce obtained from each felling section should be carefully classified, stacked, and measured so as to obtain accurate figures of yield.

(*c*) As all the coupes are within easy reach of a navigable creek, and water transport present no difficulty, if the produce is felled and stacked departmentally and delivered at the coupe the entire yield being sold in advance on a ton, cubic-yard or other unit basis, new contractors will come in and better prices will be obtained.

Departmental working presents no difficulty at Kandikuppa. Hitherto all thinnings have been felled, billetted and stacked departmentally. The work is well-established and is paid for by the stacked cubic-yard, the present rate being six annas. However, the chief reasons for departmental felling are the necessity of working to time, and the compilation of accurate figures of yield for the plantations. The advisability of selling the standing crop to contractors under suitable agreements will be considered at the end of three years ; by which time the work should be properly organized. In considering this matter the necessity of maintaining accurate records of yield must be remembered ; and if it is decided to introduce contract working, a suitable amendment will be drafted, and submitted to the Chief Conservator for sanction.

249. *Felling rules.*—Fellings will be conducted according to the following rules :—

(*a*) The period for felling will be April to June. The coupe should be completely felled and all produce stacked by the 30th June.

(*b*) Felling will commence in the section at the north-west corner of each coupe and will proceed in the order shown in the felling statement. Each section must be completely felled and all produce stacked and measured before work starts in the next felling section.

(*c*) The trees will be felled as low as possible, and the stem-wood will be sawn into billets 3 feet long. The billets will be stacked in units of one or more cubic yards the stacks being 3 feet high, 3 feet broad and 3, 6, or 9 feet in length. A ton will be reckoned as 2·6 cubic yards. The branchwood chelakara—and faggot wood—chituku—will be stacked separately in convenient lots. Faggot wood will include all branchlets and other material that can easily be broken by hand. It is generally stacked in small bundles. If any poles are extracted, they will be measured and converted into tons at 54 lb. per cubic foot measured over bark.

(*d*) Measurements of poles, stem wood, branchwood and faggot wood will be recorded separately in Code Form No. 4, separate records being maintained for each felling section.

(*e*) The contractor will not be permitted to remove the produce from any one section until the adjoining sections have been completely measured ; and all produce will be removed by the end of July.

250. *Order of felling.*—The order of felling is shown in the following fellings statement :—

Year.	Number of coupe.	Number of sections arranged in order of felling.	Area in acres.		
			Planted.	Blank.	Total.
(1)	(2)	(3)	(4)	(5)	(6)
1934–35	I	33, 36, 34, 37, 39, 35, 38, 40	69·0	9·0	78·0
1935–36	II	25, 27, 29, 31, 26, 28, 30, 32	68·0	10·0	78·0
1936–37	III	17, 19, 21, 23, 18, 20, 22, 24	68·5	9·5	78·0
1937–38	IV	9, 12, 14, 16, 10, 11, 13, 15	63·0	15·0	78·0
1938–39	V	1, 2, 3, 4, 5, 6, 7, 8	70·0	8·0	78·0
1939–40	VI	71, 72, 75, 73, 76, 74, 77, 78	72·0	4·0	76·0
1940–41	VII	63, 67, 64, 68, 70, 65, 66, 69	77·5	0·5	78·0
1941–42	VIII	55, 56, 60, 57, 61, 58, 59, 62	77·5	0·5	78·0
1942–43	IX	47, 48, 52, 49, 53, 50, 51, 54	77·5	0·5	78·0
1943–44	X	41, 44, 42, 45, 43, 46, 79, 80	70·5	7·5	78·0
		Total area of felling series	713·5	64·5	778·0

251. *Removal of stumps.*—When the rains break, and all produce has been removed by the contractor, the stumps will be extracted by means of a stump-puller. The work will proceed in the same order as the fellings. The stumps will be collected in heaps of 100 stumps which will be the unit for sale purposes. The stumps are used largely for burning bricks and find a ready sale at Kandikuppa. The yield will be recorded in a measurement book, separately for each section.

SECTION 6.—PLANTING.

252. *Collection of seed.*—A one-acre plot of the best quality now ten years old, has been heavily thinned and will be maintained for the production of seed until it declines with age. Seed will be collected from this plot; but if in any year it fails to produce seed, or produces insufficient seed, the collection will be made from well grown dominant trees in first quality crops. The seed will be collected from the trees in October or November, just before the cones burst open. The cones will be dried in the sun on mats, and the seed collected, screened, and then stored in a dry earthen pot, the mouth being carefully closed to prevent ants getting in. One pot-ful of seed, of the size ordinarily used for watering the plantation, will meet all requirements.

253. *Nursery work.*—Nurseries will be established at a convenient place near the middle of each coupe in December of the year that the coupe is felled. On an average about 70,000 plants will be wanted for planting in the following July, and about 20,000 plants for replacing casualties in the year of planting and at the beginning of the following rains. A plot of ground two chains square will be selected in a suitable locality, and fenced with Casuarina brushwood obtained from the fellings; a well will be excavated in the middle of the plot and the nursery beds arranged around the well. The established method of sowing gives good results and will be continued until a better method is discovered. Briefly, it is as follows :—

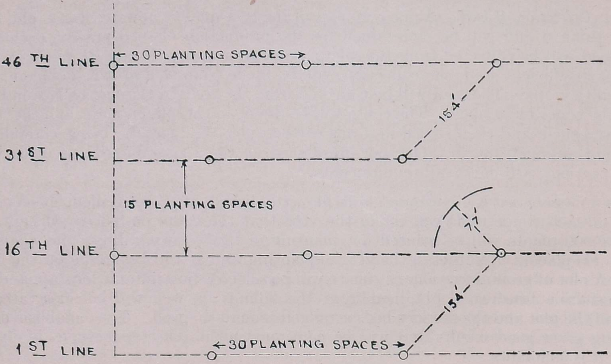
> The nursery beds are excavated about six inches below ground in pure fine sand. Before the seed is sown, sheep manure is spread lightly over the surface of the beds which are then hoed to a depth of about nine inches, the manure being intimately mixed with the sand. When the hoeing is complete the sunken beds are tamped with the hands until the surface is fairly firm. The seed is then sown broadcast, and fine sand is sprinkled over the seed through a bamboo sieve until the seed is just covered. The beds are then watered profusely with a watering can fitted with a fine rose. Meanwhile the sides of the beds are watered and tamped to prevent the sand falling into the beds. Thereafter the beds are watered regularly both morning and evening, about one pot of water being used for two square feet of surface. The seed germinates readily and the beds are generally fully stocked. The beds will be sown about the middle of December, and there will be no transplanting until the following July, but congested patches of seedlings will be thinned by pulling out the poorer plants. There must be no disturbance of the seedlings to be planted in July, so that they may develop as large a tap-root as possible before being removed from the nursery beds ; and the seedlings will be dug up and not pulled out of the beds. The plants used for replacing casualties must be large enough to amalgamate with the crop. At present most of the small plants used for replacing casualties lag behind and are ultimately suppressed. When the beds are broken up for planting in July, 5,000 healthy seedlings will be pricked out in the nursery lines at an espacement of 9″ × 9″. These transplants will be used for replacing casualties at the beginning of the rains the year after planting. About 15,000 plants will be wanted for replacing casualties in the year of planting, and separate accommodation will be provided in the nursery for these plants. The seedlings for replacing casualties in the first year will not be transplanted but thinned in the nursery beds to an espacement of 4″ × 4″ in April or May. No casualties will be replaced after August the year after planting. In August the nursery will be abandoned and the ground occupied by the nursery will be planted with the large transplants thus completing the regeneration of the coupe.

254. *Fencing.*—The coupe to be planted will be fenced with five strands of barbed wire before the beginning of June. The fence must be cattle-proof.

255. *Preparation of the ground.*—At the beginning of June the ground will be laid out for planting, one section being completed before work commences in the next section. The sections will be staked out at an espacement of 7′ × 7′ as accurately as possible, thin Casuarina stakes about 18 inches long being used to mark the centre of each planting pit.

At present there are three water-holes per acre. This is somewhat excessive, and the number will be reduced to two per acre. The water-holes will be located as follows :—

In the first planting line a stout peg will be driven at the 16th stake, and thereafter at every 30th stake. In the 16th planting line a stout peg will be driven at the first planting stake, and thereafter at every 30th stake. After this, the arrangement will alternate at every 15th planting line. The pegs will locate the centre of each water-hole. The sketch below illustrates the arrangement of the water-holes :—



The planting pits will be dug 18 inches deep at the natural slope of the soil. When the planting pits have been dug and the water-holes have been excavated the stakes will be collected and the work continued in the next section. On account of the drift sand the sections along the seaboard will be staked out last and planted first.

256. *Planting.*—Planting will be done in suitable weather at the commencement of the rains. The work must be well organized and closely supervised. One section will be planted at a time, and the work in each section must be complete before planting commences in the next section. Special care must be taken that the tap-root is not bent in planting, the pits being deepened if necessary to prevent this.

SECTION 7.—TENDING.

257. *Watering.*—The plants will be watered during breaks in the rains, in the first hot weather after planting, and at other seasons in the first year if the plants appear to need water. Watering will be continued during breaks in the rains of the second year if necessary. Thereafter there will be no watering. As this is the chief item of expenditure in raising Casuarina plantations, the work must be properly organized on a section basis, the coolies being given definite tasks expressed in the lines per section per coolie per day, or in coolies per section per day, whichever is more convenient. Watering needs careful supervision.

258. *Pruning.*—In the fourth year after planting, all side branches will be pruned from 7 to 8 feet above ground.

259. *Thinning.*—With an original planting espacement of 7′ × 7′ there are approximately 900 stems per acre, and the crop becomes congested towards the end of the fifth year. In the current working plan it was prescribed that alternate diagonal lines should be cut out in the sixth year thereby removing a half of the crop and leaving the final espacement approximately 10′ × 10′. A pure mechanical thinning has been found to be unsatisfactory, for large numbers of dead, dying and suppressed stems are left standing in the unthinned lines while vigorous healthy stems adjoining them are removed from the thinned lines. The data collected from the sample plots, which have been referred to in section 3, showed that a pure mechanical thinning in the sixth year would leave only 293 active trees in the final crop instead of 436. To test this figure a pure mechanical thinning was made in a one-acre plot of average quality in the sixth year after planting, and the number of active healthy stems left on the acre after thinning was found to be 298. There is no room for dead, dying and suppressed stems in a short rotation fuel crop, and every 10′ × 10′ unit of growing space in the final crop should be producing wood. It is therefore prescribed that thinning will be carried out in the sixth year on the following lines :—

(1) First do an A grade thinning removing all dead, dying and suppressed trees ;

(2) then do a mechanical thinning along alternate diagonal lines leaving a suitable stem standing in the thinned lines to balance every blank space in the unthinned lines. This will automatically result in the removal of 50 per cent of the crop and there will be no overthinning.

There is no doubt that an early and moderately heavy thinning is silviculturally desirable, for, apart from the fact that Casuarina is a strong light-demander, free circulation of air throughout the plantation appears to be necessary, particularly in the hot weather. But we know nothing definite about the economic benefits that are derived from the thinnings in increasd yield per acre ; nor has it been established that a modified mechanical thinning on the lines prescribed in the plan, will give better results than a silvicultural thinning. In order to investigate these matters the following experiment will be carried out :—

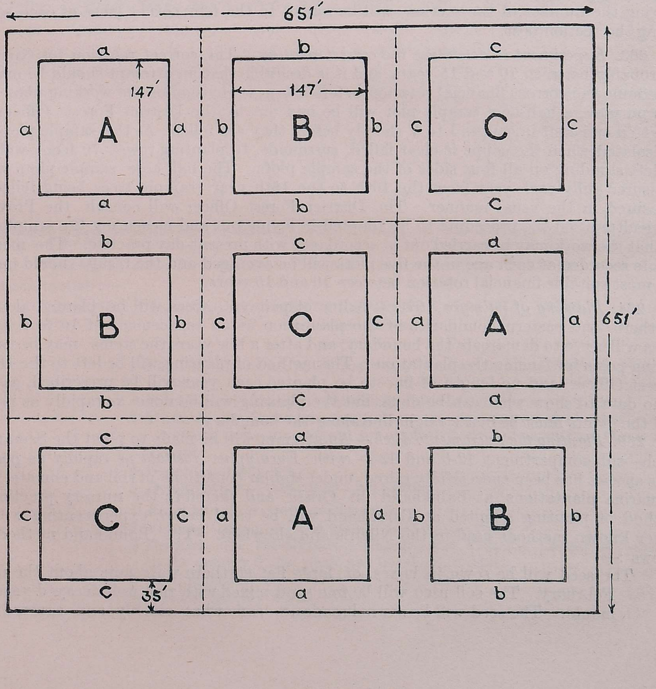
In each of the first five coupes to be thinned after April 1st, 1934, a square plot measuring about 9·7 acres will be selected in the most uniform and representative part of the coupe. The sides of the plot will measure 93 plantings spaces or 651 feet. It is unnecessary that all five plots should be strictly comparable as the randomised arrangement will ensure comparability to a greater extent than would be possible by visual selection. Each plot will be laid out in the form of a Latin square containing 9 sample plots, each 21 planting spaces—147 feet—square ; and each sample plot will have a surround, 5 planting spaces—35 feet—in width. The lay-out is illustrated below. The sample plots will be subjected to three different methods of treatment :—

(1) The sample plots A, and their surrounds, a, will be thinned in accordance with the prescriptions of this chapter.

(2) The sample plots B, and their surrounds, b, will be thinned silviculturally. The intensity of thinning being, Ordinary—C grade, as defined on page 219 of Volume II of ' The Silviculture Research Manual.'

(3) The sample plots C, and their surrounds, c, will not be thinned.

PLAN
SHOWING
LAY OUT OF THE SAMPLE SPOTS



The District Forest Officer will thin the sample plots ; and a careful record will be maintained of the number of trees removed and left standing when each sample plot is thinned, and the quantity of fuel obtained from each sample plot when thinned, and when clear-felled at the end of the rotation. As five consecutive coupes will be treated on these lines, 15 sample plots will have been subjected to each method of treatment at the end of the rotation, and the mean results for each series of 15 sample plots should be sufficiently precise for a reliable comparison of the yields obtained under the three different methods of treatment.

260. *Eradication of climbers.*—The climber *Leptodenia reticulata* is found in parts of the plantation chiefly on hummocky ground. It is not common but does a great deal of damage where it grows undisturbed. It will be eradicated in the coupes that are felled, planted, pruned and thinned each year.

SECTION 8.—OTHER REGULATIONS.

261. *Grazing.*—The grassy hummocks to the east of the Casuarina plantation, and the strip of green sward bordering the northern boundary, are the chief grazing grounds of the locality, consequently it is difficult to prevent cattle from straying into the plantation. Complete closure to grazing is impracticable unless the entire plantation is fenced against cattle. The plantations that are under three years old contain a fair crop of grass which attracts cattle, but grazing is definitely injurious in the young coupes and cannot be permitted until some time after the side branches are pruned, that is till the end of the fourth year. The old coupes contain no grass and cattle do little damage in these areas. It is therefore prescribed that all coupes under four years old will be closed to grazing and protected with a fence containing five strands of barbed wire. The area closed to grazing is small averaging only 312 acres, and there ought to be no difficulty in effectively protecting this area. The fence should be patrolled daily and any damage noticed will be repaired immediately. The cutting of grass in the young coupes should be permitted and encouraged.

262. *Demarcation.*—All ten coupes will be demarcated in 1934–35, with Casuarina posts 5 feet high and teak-wood boards bearing the number of the coupe on each side of the line. No lines will be cut ; but when the coupe is being re-planted one row of plants will be omitted leaving a line 14 feet wide between the coupes. The sections will be demarcated in the coupes that are to be pruned, thinned, felled, and planted each year, before work starts. A Casuarina post 5 feet high will be erected at the corners of each section, and the upper 2 feet will be whitewashed with lime. Painted tin plates, 6 inches square, bearing the number of the section, will be nailed to the four corner trees of each section facing the section post.

263. *Experiment to determine the correct rotation.*—The correct rotation for Casuarina is probably between 10 and 15 years, and it is desirable that an attempt should be made to determine the correct financial rotation before the next revision of the working plan. For this purpose, a half-acre sample plot will be laid out by the District Forest Officer or a gazetted assistant in coupes I to V shortly before they are felled. As the sample plots will be isolated when the coupe is clear-felled, surrounds, 10 planting rows—70 feet—wide will be left standing on all four sides of the sample plots. The half-acre sample plots will be measured fully each year from the 10th to the 15th year, sample trees being felled and measured in the usual manner. The District Forest Officer will consult the Provincial Silviculturist on the procedure to be adopted in laying out and measuring the sample plots so that the work may be carried out in accordance with present-day practice. The measurements recorded at each age in the five plots will be averaged and the results should indicate the most suitable financial rotation between 10 and 15 years.

264. *Planting of palmyra trees.*—A line of palmyra trees will be planted along the northern and eastern boundaries of the plantation at an espacement of 10 feet. These trees will serve to demarcate the boundary, and after a few years the stems may be used as wiring posts for fencing the plantation. The method of planting will be left to the District Forest Officer, and no length of line to be planted each year will be prescribed, as there is no data to show what can be done, but the planting will be done as rapidly as possible and the plants must be in a straight line along the boundary.

265. *Planting the Sacramento ditch.*—An attempt will be made to plant the Sacramento ditch—sub-compartment 12-*b* and 12-*c*—with *Eucalyptus rostrata* as rapidly as possible. This species has been successfully raised, under similar conditions of soil and climate, in the Casuarina plantations, at Balukhand in Orissa, and therefore the nursery practice and method of planting adopted at Balukhand will be tried before experimenting with the better known methods used in the Nilgiris and elsewhere. The Balukhand method is as follows :—

> The seed will be sown in boxes, or large flat earthern-ware pots about the end of February. The soil used will be fine sand mixed with rich well-decayed vegetable mould. The seed will be sown broadcast, somewhat thickly, and covered with

about one-tenth inch of fine sand preferably sprinkled through a sieve. The seed boxes or pots will be sheltered from sun and rain and watered lightly twice a day, morning and evening, using a watering-can with a fine rose. When the seedlings are about 2 inches high—about two months after sowing—they will be pricked out singly into cylindrical pot-tiles about 9 inches long and 4 inches in diameter at the broad end, and the pot-tiles will be embedded in sand leaving about half an inch exposed thus forming a bed. Before being pricked out into the pot-tiles, the seedlings should be hardened by exposure to the sun for an increasing period each day. The pricking out should be done with great care in the cool of the evening as the seedlings are very delicate. Afrer being transplanted in the pot-tiles the seedlings will be shaded for about a week and then gradually exposed to full sun light, being protected against strong winds and the powerful afternoon sun by side shades. The plants should be from 6 to 12 inches high when they are planted out at the beginning of July. The pot-tiles with the plants are dug out of the beds and carried to the planting ground in baskets. Each basket of potted plants is dipped in water for a few seconds. This facilitates the removal of the plant from the pot complete with earth. The sides of the pots are tapped lightly on the ground two or three times the pot being rotated between the taps. The plant is then seized at the collar and withdrawn from the pot complete with earth. After planting, the plants will be watered in the same manner as the Casuarina plants. If the Balukhand method of raising *Eucalyptus rostrata* fails, other methods will be tried in consultation with the Provincial Silviculturist, and if *Eucalyptus rostrata* fails, *Melaleuca leucodendron* will be tried as it grows well at Balukhand under similar conditions. As the work is experimental definite areas for planting have not been allotted, but the Sacramento ditch must be planted as rapidly as possible.

SECTION 9.—TABULATED SUMMARY OF OPERATIONS.

266. *Work to be done annually.*—The following statement shows the work to be done each year :—

ANNUAL CALENDAR OF WORKS.

Year.	Number of coupe.						Coupe in which rotation sample plots will be laid out.	Coupe in which thinning plots wil be laid out.	Coupes in which half-acre of the rotation sample of plots of the following ages will be measured.				
	To be demarcated.	In which sections will be demarcated.	To be felled.	To be planted.	To be pruned.	To be thinned.			11 years.	12 years.	13 years.	14 years.	15 years.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1934–35 ..	II to X	II, VI, VIII.	I	Nil	VIII	VI	1	VI	..	..	..	..	..
1935–36 ..	..	III, VII, X.	II	I	IX	VII	II	VII	I	..	..	..	..
1936–37 ..	..	V and X.	III	II	X	VIII	III	VIII	II	I	..	..	..
1937–38 ..	..	V	IV	III	Nil	IX	IV	IX	III	II	I	..	..
1938–39 ..	..	..	V	IV	I	X	V	X	IV	III	II	I	..
1939–40 ..	..	..	VI	V	II	Nil	..	..	V	IV	III		
1940–41 ..	..	..	VII	VI	VI	I	..	..	..	V	IV	III	II
1941–42 ..	..	..	VIII	VII	IV	II	..	..	..	..	V	IV	III
1942–43 ..	..	..	IX	VIII	V	III	..	..	..	..	..	V	IV
1943–44 ..	..	..	X	IX	VI	IV	..	..	..	..	..	..	V
1944–45 ..	..	..	I	X	VII	V	..	..	..	..	..	..	..

Note.—The rotation half-acre sample plots and their surrounds, measuring 41 planting rows square or approximately 1·9 acres, will be left standing when coupes I to X are felled.

267. *Work to be done each month.*—The following statement shows the work to be done each month :—

MONTHLY CALENDAR OF OPERATIONS FOR THE FINANCIAL YEAR.

Month. (1)	Particulars of work. (2)
April	1 Final felling in coupe of the year, and measuring of rotation sample plots. 2 Pricking out Eucalyptus seedlings into the pot-tile nursery lines. 3 Thinning the Casuarina seedlings to an espacement of 4″ × 4″ in the nursery beds maintained for replacing casualties during the current year. 4 General nursery work. 5 Demarcation of remaining nine coupes.
May	1 Final felling in coupe of the year. 2 Fencing the coupe to be planted during the year. 3 Pricking out Eucalyptus seedlings, and thinning Casuarina seedlings in the nursery if this work was not done in April. 4 Sowing palmyra seed along the boundary. 5 General nursery work.

Month. (1)	Particulars of work. (2)
June	1 Final felling will be completed in the coupe of the year. 2 Laying out and demarcating sections in the coupe to be planted, if this has not already been done. 3 Staking out the area to be planted during the year and digging water-holes. 4 Planting, if the rains are early. 5 Transplanting 5,000 Casuarina plants in the nursery lines at an espacement of 9″ × 9″ if the rains are early.
July	1 Completion of removal of all produce. 2 Planting if not done in June. 3 Transplanting Casuarina seedlings 9″ × 9″ if not done in June. 4 Planting *Eucalyptus rostrata* in the Sacramento ditch. 5 Replacement of casualties in the area planted in the previous year an during the current year.
August	1 Replanting casualties in areas already referred to. 2 Breaking up the old nursery at the end of the month and planting it with Casuarina. 3 Removal of stumps from area felled during the year.
September	Removal of stumps.
October	1 Collection of seed. 2 Removal of stumps.
November	Collection of seed if not done in October.
December	1 Preparation of new nursery in coupe felled during the year. 2 Sowing seed beds with Casuarina. 3 Demarcation of the sections of the coupe to be pruned next month if this has not already been done.
January	1 Pruning and eradication of climbers in the area pruned. 2 General nursery work. 3 Demarcation of the sections of the coupe to be thinned next month if this has not already been done.
February	1 Laying out of thinning experimental plots. 2 Selection and demarcation of rotation sample plots. 3 Thinning and eradication of climbers in the area thinned. 4 Sowing seeds of *Eucalyptus rostrata* in the nursery towards the end of the month. 5 General nursery work.
March	1 Demarcation of the sections of the coupe to be felled in April if this has not already been done. 2 General nursery work. 3 Complete thinnings if not already complete.

Note.—1. Watering will be done in the hot weather and at other seasons when necessary.
2. Some of the operations will be later than usual in 1934, the first year of working.

SECTION 10.—FORECAST OF THE FINANCIAL RESULTS FOR THE PERIOD COVERED BY THIS WORKING PLAN.

268. *Cost of the plantation.*—The expenditure incurred on the Casuarina plantation from the commencement of operations in 1924 up to the time of writing this chapter, is Rs. 16,352-6-9, and it is estimated that on April 1st, 1934, when the growing stock will be fully constituted, the total expenditure will be Rs. 16,917-9-8. This figure does not include interest charges and expenditure on the establishment. If simple interest is charged, for the whole period of ten years, at 6 per cent per annum on the total expenditure incurred up to the beginning of each year, and at 3 per cent per annum on the expenditure incurred during each year, the total charge for interest will amount to Rs. 4,517-1-0 up to March 31st, 1934. Establishment and overheads, based on actuals, is reckoned to cost Re. 1 per acre per annum amounting to Rs. 7,135 for the ten years. Therefore the total cost of the plantation will be :—

	RS.	A.	P.
Actual expenditure on works	16,917	9	8
Interest charges	4,517	1	0
Establishment charges	7,135	0	0
Total ..	28,569	10	8

The revenue derived up to date from the areas planted during the past ten years is Rs. 7,543. Deducting this amount from the gross expenditure the actual cost of establishing the Casuarina plantation will be Rs. 21,026–10–8, or, in round figures, Rs. 21,000. On April 1st, 1934, the growing stock will be fully constituted consisting of a complete series of age-gradations occupying more or less equal areas, and the final crop will be ready for felling. The capital expenditure will be complete, and the amount invested by Government in the Kandikuppa Casuarina plantation will be Rs. 21,000. The wooded area is 713·5 acres and the mean cost per acre, all in, will be Rs. 29–7–0.

269. *Estimated yield.*—In the Kandikuppa Casuarina plantation there are no mature crops of average quality. The only crop that had attained the rotation age of 10 years when this working plan was being prepared was an experimental plantation of 15 acres planted in 1923. This plot is of markedly better quality than the rest of the plantation. The area planted in 1924, next in age, is the poorest in the plantation, and definitely below average quality. Consequently the estimates of yield have been based on measurements recorded in the 1923 plantation, due allowance being made for quality and stocking. The 1923 plantation is more or less fully stocked containing on an average, between 420 and 430 trees per acre. An analysis of a series of thinned plots of different ages in the main plantation which has been referred to in section 3 of this chapter showed that the number of trees left standing for the final crop after thinning in the better stocked areas was 367 per acre ; and that the average crop would contain appreciably less. It has been roughly estimated that the average number of trees per acre at maturity for the whole plantation would be from 300 to 320. The casualties are not evenly distributed throughout the crop : they generally occur in groups and patches. Taking both quality and stocking into consideration it is estimated that the yield from the average coupe will be about 65 per cent of that obtained from the 1923 plantation. A sample plot of one acre was measured in the 1923 plantation when it was ten years old ; and six months later, 11·85 acres of this plantation was felled and measured. Details of the measurements recorded will be found in Part I, Chapter VI. It was found that the mean yield of stem-wood per acre was 35 tons. Therefore the estimated yield of stem wood from the final coupe for the whole plantation would be 65 per cent of 35 tons or approximately 23 tons. Branchwood and faggot-wood is estimated to yield 2½ tons per acre, making the total yield 25½ tons or, in round figures, 25 tons.

270. *Forecast.*—It is estimated that the mean revenue and expenditure during the period of the plan will be somewhat as shown below :—

RECEIPTS.				EXPENDITURE.			
Particulars.	Amount.			Particulars.	Amount.		
(1)	(2)			(1)	(2)		
	RS.	A.	P.		RS.	A.	P.
1 From sale of faggot-wood from pruning 75 acres at Rs. 2-12-0 per acre	206	4	0	1 Cost of pruning 75 acres at Re. 1 per acre	75	0	0
2 From sale of billetted fuel from thinning 75 acres yielding 10 cubic yards per acre at Rs. 2 per cubic yard	1,500	0	0	2 Cost of thinning 75 acres yielding 10 cubic yards per acre at As. 6 per cubic yard	281	4	0
3 From sale of branch-wood and faggot-wood from thinning 75 acres at Rs. 2 per acre ..	150	0	0	3 Cost of felling and stacking the stem wood obtained from the final crop yielding 23 tons per acre at Rs. 1-2-0 a ton of 3 cubic yards	1,811	4	0
4 From sale of billetted wood obtained from final crop of 70 acres yielding 23 tons per acre at Rs. 6 per ton	9,660	0	0	4 Cost of extracting stumps on 70 acres at Rs. 10 per acre ..	700	0	0
5 From sale of branch-wood and faggot-wood obtained from final crop of 70 acres at Rs. 6 per acre	420	0	0	5 Cost of planting 78 acres with Casuarina at Rs. 25 per acre, all in	1,950	0	0
6 From sale of stumps on 70 acres of final crop at Rs. 15 per acre.	1,050	0	0	6 Cost of planting 5 acres with Eucalyptus at Rs. 25 per acre	125	0	0
				7 Establishment and overhead charges for 780 acres in the Casuarina felling series, and 51 acres in the Sacramento ditch, 831 acres at Re. 1 per acre	831	0	0
				8 Miscellaneous unforseen expenditure	212	12	0
				Total ..	5,986	4	0
				Add profit ..	7,000	0	0
Total ..	12,986	4	0	Total ..	12,986	4	0

As the plantation will be more or less fully constituted on April 1st, 1934, the capital account will be closed, and all the expenditure shown in the financial forecast will be charged against the revenue account for the year. No interest will be payable, but the profit on the years working will be the return on the capital invested. If the forecast proves accurate the Casuarina Working Circle will pay a dividend of approximately 33 per cent per annum.

SECTION 11.—CONTROL.

271. *Control Records.*—The following control records will be maintained :—

(1) the Control Book,
(2) the Record of Works,
(3) the Plantation Journal,
(4) the Record of Deviations, and
(5) the Control Map.

Sample forms for the control book and the record of works, and sample headings for the plantation journal will be found in Appendix VIII. The Control map will be maintained on a scale of 8 inches to a mile, a copy of the working plan map being used for this purpose. It will show the areas planted, pruned, thinned and felled each year, the area planted with *Eucalyptus rostrata* in the Sacramento ditch and the experimental plots that have been laid out and demarcated.

CHAPTER V.—WORKING PLAN FOR THE TIMBER CLEAR-FELLING WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION OF THE CIRCLE AND CHARACTER OF THE VEGETATION.

272. *General constitution of the circle.*—The working circle includes all the patches of forest in Beddadanole and Kopalli reserves and Kovvada block I, in which teak forms more than 10 per cent of the growing-stock, and where the soil is suitable for growing teak. These patches of forest occur mainly in the north-east quarter of Beddadanole reserve, and on the flat or gently sloping ground bordering on parts of the boundary line at the southern extremity of Kopalli reserve and the western end of Kovvada block I.

273. *Character of the vegetation.*—The growing-stock consists of an open degraded crop of teak, rarely over 3½ feet in girth, associated with *Terminalia tomentosa, Pterocarpus marsupium, Lagerstroemia parviflora,* and other inferior species, the proportion of teak ranging from 10 to 40 per cent of the growing-stock. The outstanding feature of the crop in the Beddadanole reserve is the damage done by fire and climbers : almost all the teak trees are fire-scarred or otherwise damaged, and the better areas are festooned with *Butea superba, Ziziphus oenoplia* and other large climbers. There are not so many climbers in the teak patches of Kopalli reserve and Kovvada block I, but bamboo is more plentiful ; otherwise the growing-stock is similar to that in Beddadanole reserve. Though the present crop is degraded and of little value, it contains sufficient saleable timber to cover the cost of re-establishing these forests.

SECTION 2.—PERMANENT DIVISION INTO BLOCKS AND COMPARTMENTS.

274. *Forest blocks unnecessary.*—The patches of teak forest included in the working circle are scattered over three reserves. There are 24 patches forming a group in the Beddadanole reserve, and 26 patches strung out along the boundary line of Kopalli reserve and Kovvada block I, in the neighbourhood of Puliramudugudem, the two areas being about twelve miles apart. The management does not necessitate the subdivision of each reserve into separate forest blocks, and it will suffice if the teak compartments are distinguished by the name of the reserve in which they are situated, namely, the Beddadanole compartments, and the Kopalli-Kovvada compartments.

275. *Compartments.*—All the teak areas in Beddadanole reserve have been surveyed and marked on the 4-inch working plan map. There are thirty-five separate plots ranging in area from 3 acres to 652 acres. The timber coupes worked from 1922–23 to 1931–32 form the largest plot—a compact block situated astride the Bothappagudem-Ankhanagudem road. The entire area of these timber coupes is not strictly suitable for inclusion in the working circle ; but, if all the unsuitable portions were excluded, the coupes would be badly cut-up and this would cause confusion. It has therefore been decided to exclude only about 50 acres which are particularly poor, and to incorporate the remaining 549 acres in the working circle making arrangements for the proper tending of these old coupes. The teak plots occupy separate areas, and for purposes of management it is necessary that each plot should be identified. Ordinarily, the compartments in a forest block do not differ greatly in area, whereas there is considerable difference in the areas of the teak plots. But this is immaterial, and each plot will form a separate compartment. There are thirty-five teak compartments in Beddadanole reserve of which only twenty-four will be included in the working circle ; the remaining eleven compartments contain scattered stunted teak growing on poor soils and are unsuitable for growing teak. Twenty-six teak plots ranging in area from 2 acres to 230 acres have been surveyed in Kopalli reserve and Kovvada

block I; they will form twenty-six compartments, and all will be included in the working circle. The isolated patches of scattered inferior teak growing on stony soils in Kopalli reserve and Kovvada block I have not been surveyed. The following statement shows the distribution and area of the compartments included in the Timber Clear-felling Working Circle :—

Name of reserve. (1)	Compartment number. (2)	Area in acres. (3)	Remarks. (4)
Beddadanole	1	41·0	The following teak compartments which contain scattered stunted teak growing on poor soils, are not included in the working circle :—
	5	21·0	
	6	82·0	
	8	549·0	
	9	243·0	
	10	69·0	
	11	33·0	
	12	14·0	
	13	70·0	
	14	16·0	
	15	68·0	
	16	40·0	
	17	30·0	
	18	169·0	
	20	34·0	
	21	58·0	
	25	16·0	
	26	8·0	
	28	23·0	
	29	13·0	
	32	3·0	
	33	10·0	
	34	15·0	
	35	7·0	
	Total area ..	1,632·0	
Kopalli-Kovvada	1	35·0	
	2	90·0	
	3	10·0	
	4	60·0	
	5	4·0	
	6	51·0	
	7	33·0	
	8	74·0	
	9	230·0	
	10	8·0	
	11	2·0	
	12	5·0	
	13	34·0	
	14	62·0	
	15	64·0	
	16	2·0	
	17	2·0	
	18	172·0	
	19	21·0	
	20	75·0	
	21	5·0	
	22	116·0	
	23	9·0	
	24	7·0	
	25	50·0	
	26	40·0	
	Total area ..	1,261·0	
Total area of the working circle ..		2,893·0	

Compartment number. (1)	Area in acres. (2)
2	280·0
3	6·0
4	3·0
7	133·0
19	4·0
22	4·0
23	8·0
24	7·0
27	6·0
30	9·0
31	6·0
	466·0

SECTION 3.—FELLING SERIES AND REASONS FOR THEIR FORMATION.

276. *Felling Series.*—The forests of this working circle supply two different markets. The timber from Beddadanole reserve is taken to Jangareddigudem from where it is exported to Ellore and other markets in the West Godavari district; while the timber from Kopalli reserve and Kovvada block I, is taken to Kannapuram, and from there to Kovvur, Rajahmundry, and other markets in the East Godavari district. In order to dispose of the yield from the working circle as advantageously as possible it will be necessary to supply both markets, consequently there will be two felling series :—

	Area. ACS.
1 The Beddadanole felling series	1,632
2 The Puliramudugudem felling series	1,261

SECTION 4.—ANALYSIS AND VALUATION OF THE CROP.

277. *Analysis of the crop.*—There was no necessity to make a detailed analysis of the growing-stock. The teak forests included in the working circle were selected in the manner already explained, and the selected areas were surveyed and marked on the 4-inch working plan map.

278. *Valuation of the crop.*—For want of reliable data no attempt has been made to value the growing-stock.

SECTION 5.—METHOD OF TREATMENT.

279. *The objective.*—The chief demand is for timber ; fuel is saleable only in small quantities and at a low price. Therefore, although the working circle cannot produce large timber, it will be managed for the production of the best timber that can be grown in this locality. The poorly-stocked, mixed, irregular, coppice crops will be converted into a forest of timber poles up to about 3½ feet in girth. Teak will form the bulk of the growing stock and will be favoured against all other species, but no attempt will be made to grow pure teak, and full advantage will be taken of all *Pterocarpus marsupium, Terminalia tomentosa*, and *Lagerstroemia parviflora*, that is found growing in the coupes. The regeneration of these species will be encouraged, and the young coppice will be suitably tended so as to produce straight well-grown poles. The forests are incompletely stocked—on an average the stands of timber are less than a half of the possible capacity of the forests—and the stocking will have to be done artificially. The raising of mixed crops artificially is somewhat difficult, and requires more supervision than will be available in the working circle. Besides, it is unnecessary, as there is already a natural mixture which will be utilized and controlled for silvicultural purposes. Only teak will be used for artificial regeneration in the felled coupes. Climbers will be eradicated, and the regenerated areas will be carefully protected against fire.

280. *The silvicultural system.*—The silvicultural objective can best be obtained by clear-felling, with supplementary stumping of teak, regeneration being obtained partly from coppice and partly from teak stumps. This method of treatment is an adaptation of what is known in Madras as the "Walayar System" from the name of the forest where it was first introduced. It makes full use of the existing crop for regeneration purposes, and utilizes the productive capacity of the soil by artificially restocking all suitable blanks, and all areas that are incompletely stocked. The system is flexible and can be modified to suit local conditions. It is necessary to guard against two things :—

(1) No attempt must be made to mingle artificial regeneration with coppice, in close formation, particularly if the coppice has been given a growing start. The consequences are so obvious that this warning will appear unnecessary. Nevertheless, it has been attempted, and must be avoided.

(2) No attempt must be made to regenerate natural blanks and under-stocked areas which are unsuitable for the species that is being introduced artificially.

In actual operation, the system will be as follows :—

The coupe will be clear felled. As the areas included in the working circle have been specially selected, there will not be as much unsaleable material to be felled as there was in the old timber coupes ; and as the coupes are incompletely stocked, there will be insufficient slash to ensure a good burn over the entire coupe. Early in May, the year after felling, parallel lines will be laid out 6 feet apart ; all regrowth will be cut back ; and the slash will be collected in strips along these lines, care being taken not to pile too much slash alongside promising stools of teak, *Pterocarpus marsupium, Terminalia tomentosa* and *Lagerstroemia parviflora.* The coupe will then be burnt. This work will be done departmentally. At the end of May the coupe will be staked out for stumping, in parallel lines 6 feet apart, the lines following the burnt strips. Stakes about 3 feet long will be planted at intervals of 6 feet along the lines unless there is a coppice stool of teak, *Pterocarpus marsupium, Terminalia tomentosa* or *Lagerstroemia parviflora* under 15 inches in diameter, within a radius of 5 feet, when a small peg will be driven into the ground to indicate that planting at this point is unnecessary. The stools of teak and *Terminalia tomentosa* are easy to identify and the stools of *Pterocarpus marsupium* exude a characteristic red gum, but there may be some difficulty in identifying the stools of *Lagerstroemia parviflora*. However, if there is any doubt about the stools, the position will be marked for stumping. In the first week of June, one year old teak stumps will be planted at all the large stakes in the manner which will be described later in this chapter, and thereafter the crop will be tended with the express object of producing straight well-grown poles. On an average, coppice regeneration will cover from 40 to 50 per cent of the ground, and the remaining 50 to 60 per cent will be regenerated with teak stumps. This description may convey the impression that coppice shoots and teak stumps are to be mixed in the very manner that has already been deprecated, but in actual practice it will not be so. Over the greater part of the felled coupes coppice regeneration will occur in groups, and there will be patches of varying size which will be completely regenerated with teak stumps. The intermediate area will contain both coppice and teak stumps, but, as there will be no stumps within 5 feet of a coppice shoot, and as the coppice will not be given a growing start, and as the area will be carefully tended, there is no danger of suppression.

281. *The rotation.*—It has been shown in Part I, Chapter VI, that in the Polavaram range teak attains a mean diameter of 11·2 inches, over bark, in 50 years. Most of the teak trees that were analysed to determine the rate of growth exhibited marked periods of suppression, and it is estimated that, if properly tended and protected from fire, teak should attain a girth of about 3½ feet, over bark, in 50 years. The object of management is to grow timber poles up to about 3½ feet in girth ; and as teak will form the bulk of the crop, the mean age at which it attains this size will be the correct rotation. The subsidiary species are probably slower growing than teak, but they ought to attain a girth of at least 3 feet in 50 years, and poles of these species are saleable when over 2 feet in girth. It has therefore been decided to adopt a rotation of 50 years.

282. *Regulation of the yield.*—The yield will be prescribed and regulated by area.

SECTION 6.—METHOD OF EXECUTING THE FELLINGS.

283. *Felling rules.*—The following rules will apply to both felling series :—

(1) The coupe will be divided into three more or less equal strips, the strip lines running across the width of the coupe. Each strip must be completely felled before work may commence in the next.

(2) All growth will be felled, whether it is saleable or not, including trees which yield minor produce.

(3) All trees, except soft woods that are of no value, will be felled as low as possible : not more than three inches above ground. It is unnecessary to shape or trim the stools.

(4) Fast-growing soft woods such as *Cochlospermum gossypium*, *Sterculia urens*, *Sterculia villosa* and *Erythrina suberosa*, which are of no value and are likely to suppress more valuable species, will be felled from 18 inches to 2 feet above ground.

(5) All bamboo growing in the timber coupes of the year is the property of the coupe contractor and will be clear felled and removed by him.

(6) No extension of the period for felling and extraction may be granted ; and all unfelled areas in a coupe will be felled departmentally in April, immediately after the contractor's voidah expires. As the coupes are small, the demand is good, and labour is plentiful, the unfelled area will rarely exceed 5 acres.

SECTION 7.—TABULAR STATEMENT OF FELLINGS.

284. *Allotment of coupes.*—Coupes have been allotted only for the period of the working plan, as shown in the following statement :—

Tabular statement of fellings for the Timber Clear-Felling Working Circle.

Year of felling.	Beddadanole felling series.			Puliramudugudem felling series.			Total area to be felled.
	Coupe number.	Compartment number.	Area of coupe in acres.	Coupe number.	Compartment number.	Area of coupe in acres.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1934–35 ..	I	9	33	I	18	24	57
1935–36 ..	II	20	34	II	2	24	58
1936–37 ..	III	13	35	III	20	24	59
1937–38 ..	IV	9	33	IV (*a*) & (*b*).	18 & 17	24	57
1938–39 ..	V	15	34	V	2	24	58
1939–40 ..	VI	13	34	VI	18	26	60
1940–41 ..	VII	9	33	VII	20	24	57
1941–42 ..	VIII	18	33	VIII	18	24	57
1942–43 ..	IX	15	34	IX	18	25	59
1943–44 ..	X	9	33	X	20	24	57

SECTION 8.—SUBSIDIARY SILVICULTURAL REGULATIONS.

A. Regeneration.

285. *General remarks.*—The coupes to be felled under this working plan will be regenerated partly by coppice, and partly with teak stumps. As much use as possible will be made of coppice and natural reproduction of teak, *Pterocarpus marsupium, Terminalia tomentosa,* and *Lagerstroemia parviflora,* but coppice of unsaleable species will not be permitted to take possession of soils that are suitable for growing teak. Such areas will be regenerated with teak stumps, and the inferior coppice will be kept under control until the teak is established. Thereafter, if it persists, it will be retained as an underwood. Although the areas included in the working circle have been selected carefully, there may be patches of ground which are unsuitable for teak and at the same time incompletely stocked with other saleable species. On such patches all coppice will be retained, and the saleable species will be favoured when the crop is tended.

286. *Preliminary work.*—In the first week of May, the year after felling, lines will be laid out 10 feet apart, parallel to the strip lines. As soon as this has been done, all coppice and advance growth will be cut back, particular care being taken that teak and the other three auxilliary species, are cut back low with sharp knives so that the bark ring is not lacerated. The debris will then be collected in strips, along the lines, and the entire coupe will be burnt. This work must be complete before the middle of May.

287. *Stumping.*—In the last week of May the coupe will be staked out for stumping in lines, 6 feet apart, the lines following the burnt strips. Planting stakes, which will be about 3 feet above ground, will be inserted 6 feet apart, along these lines unless there is a good stool of teak, *Pterocarpus marsupium, Terminalia tomentosa* or *Lagerstroemia lanceolata* within 5 feet of this point, when a small peg will be driven into the ground to indicate that stumping is unnecessary. In the first week of June, one year old teak stumps with a 9-inch root and 1-inch stem will be planted in crowbar holes at each planting stake. Hitherto it was thought that pre-monsoon stumping would fail in the Lower Godavari division on account of the intense heat that prevails immediately before the rains break, and the uncertainty of the *chota bursat*; but experiments in other divisions have shown that stumping can safely be done from two to three weeks in advance of the monsoon, all failures being replaced when the rains break. Great care must be taken to ensure that the stumps are planted with the earth tight around the tips. The planting coolie should test each stump to make sure that it is gripped at the tip before he closes in the earth around the upper part of the stump; and the man supervising the work should test this from time to time by digging away the soil from the upper part of a stump to a depth of about 5 inches and feeling whether the tip of the stump is firmly gripped by the soil. The reason for this is, that, in a large percentage of stumps, the initial roots spring from the last quarter of an inch of the stump, and immediate contact with the soil facilitates early establishment; whereas a cavity around the tip of the stump tends to induce rot.

288. *Collection of seed.*—Natural-grown teak is found only in the Polavaram range, which provides all the teak seed that is wanted for artificial regeneration within the division, and a small quantity is exported to other divisions in the Waltair Circle. Only about 10 per cent of the teak seed collected in the Polavaram range is obtained from the reserved forests. The large teak trees in Papikonda reserve and the two Kovvada blocks are overmature and produce very little seed, a high percentage being sterile. There are a few good seed bearers on the outer edges of the reserves; but the main sources of supply are village enclosures, isolated trees standing in private lands, and the teak avenue on the Kannapuram-Polavaram road. Little attention appears to be paid to the source of supply: the fertility of the seed is the chief consideration, and the seed collected is highly fertile producing good nursery plants. But, fertility is not necessarily an indication of vigour, for the unfit are frequently capable of prolific reproduction and it is doubtful that a nursery plant can give an indication of the shape and height of the mature tree. The teak plantations in Peddapur and Gokavaram ranges which have been raised from similar seed appear to fall away in height growth very early, and it is common to find 3-year old saplings in flower. But this may be due to the unfavourable environment. However, on broad reasoning it seems doubtful that seed obtained from the crooked, stunted avenue trees on the Kannapuram-Polavaram road will produce well-grown straight poles, no matter how favourable the environment may be; and it appears safer to work on the assumption that the characteristics of the parent plant are inherent in the seed. It can do no harm to be on the safe side, and so it has been decided to prohibit the collection of seed from stunted, malformed trees whether growing on roadside avenues or elsewhere. The District Forest Officer will investigate the sources of his seed supply recording notes on this subject in the control journal, and he will endeavour to obtain his full requirements from straight, well-grown, vigorous, healthy trees.

289. *Nursery work.*—The following instructions for nursery work were drafted by the Provincial Silviculturist :—

> "Approximately 62,000 one-year old teak stumps will be required each year by about the beginning of June, 36,000 for the Beddadanole felling series and 26,000 for the Puliramudugudem felling series. Forty beds, 40 feet long by 4 feet wide, or their equivalent, should produce this number of stumps if fully stocked ; but in order to ensure against incomplete stocking, it is preferable to have the equivalent of about sixty such beds. The ground for the nursery should be dug 9 inches to 1 foot deep and the beds made up so that they have at least 12″—15″ of worked soil in them. Teak seed should be sown in them at the end of May or the beginning of June with the seeds almost touching, i.e., approximately half an inch apart on the average. This requires about one to one-fourth bags of seed per bed 40′ × 4′. Germination is hastened by covering the beds with straw laid on twigs (*Phyllanthus emblica* twigs have been found most suitable) and watering through the straw. The straw should be removed as soon as germination has commenced. Watering will have to be done until the rains set in. The pricking out of seedlings into other beds is not recommended unless there is a shortage of seed : it is expensive and gives less satisfactory results than raising the plants direct from seed without transplanting. If desired a certain amount of thinning out may be done in the beds to about 3 inches espacement but this also is not really necessary. If on the other hand the beds are left unthinned there will be a number of suppressed plants left behind which will grow into suitable stumps as a reserve for the next year's work. Superfluous beds, if any, can be retained for use when the plants are two years old, but it may be advisable to use up the largest plants in them when twelve months old. As far as is known there is no disadvantage in using large two-year old stumps over an inch in diameter, but the Provincial Silviculturist should be consulted from time to time on this point, and upon the best methods of nursery work.
>
> The aim should be to produce stumps of more than three-eighths of an inch diameter at the thickest part (the larger the better) at a reasonable cost. If it is found that local conditions are such that stumps of this size are not produced in 12 months the nursery work should be started earlier.
>
> The Provincial Silviculturist should be consulted about the advisability or otherwise of using the same nursery site for more than one year."

290. *Replacement of casualties.*—All failures in the pre-monsoon stumping will be replaced when the rains break. Casualties will be replaced again in August when the first weeding is being done. Thereafter there will be no replacement of casualties.

291. *Necessity of good organization.*—The success of artificial regeneration depends largely on good organization. The work must be closely supervised, and completed as quickly as possible consistent with careful planting. It should not take more than a week to stump up each coupe.

B. Tending.

292. *General remarks.*—For the purpose of tending, the forests of this working circle will be grouped into three classes :—

(1) Coupes that will be regenerated during the period of the working plan,
(2) the old timber coupes and
(3) the intermediate compartments.

Each of these classes will be dealt with separately.

293. *Tending of the coupes regenerated under the prescriptions of this plan.*—The following rules will apply to both felling series :—

(1) *Preliminary climber cutting.*—In March, a month before the coupe is handed over to the contractor for felling, all climbers will be cut. It is necessary to eradicate *Butea superba* and the other large climbers which do considerable damage in parts of Beddadanole felling series ; and, as these large climbers generally grow on soft soils where felling below ground level is easy and cheap, the following method will be tried over a half of the first three coupes : the earth around the base of the stem will be excavated to permit of the climbers being felled from 8 to 9 inches below ground level. The cavities will then be filled with earth and tamped with the feet. In the other half of the first three coupes, climbers will be cut above ground ; and in part of this half the bark will be stripped off the stumps to ground level ; and over the remaining area the bark on the stumps will be hammered into a pulp with the back of an axe. The results of each method will be recorded in the control journal. If all three methods fail, the District Forest Officer will try other methods in the subsequent coupes after consulting the Provincial Silviculturist.

(2) *First weeding.*—In August of the year of regeneration, the stumped lines will be weeded to a width of 4 feet, and all casualties will be replaced. In carrying out this weeding, an experimental mamooty scraping will be tried over about 5 acres. A width of 2 feet on each side of the row of plants will be scraped free of all weeds, and the weeds will be heaped on the intervening strips.

(3) *Second weeding.*—In December of the same year there will be a second weeding, and the soil will be worked up around the teak stumps, except on the 5-acre plot ; this will be scraped with mamooties as was done in August.

(4) *Tending—the first year after regeneration.*—In May, the year after the coupe has been regenerated, the following works will be carried out :—

(*a*) All climbers will be cut.

(*b*) The coupe will be cleaned. In doing so the species will be favoured in the following order :—

Teak,
Pterocarpus marsupium,
Terminalia tomentosa, and
Lagerstroemia parviflora ;

but well-grown stems of any of the three auxiliary species will be preferred to poor, badly-shaped stems of a superior species.

(*c*) The coppice rings of teak and the three auxiliary species will be thinned, two shoots being retained at each stool, except where there is a single dominant shoot. At the same time wherever teak stumps have produced more than one shoot, the heads of competing shoots will be broken off. This prescription is tentative and will be carried out for the first four years only, during which period observations will be recorded on the results obtained. At the end of four years the question of continuing the work will be reconsidered in consultation with the Provincial Silviculturist.

(5) *Tending—the sixth year after regeneration.*—In April the sixth year after regeneration, the coupe will be cleaned, climbers will be cut, and the young crops of teak and the auxiliary species will be thinned, if this is silviculturally desirable.

(6) *Intermediate tending.*—Any intermediate tending that may be found silviculturally desirable between the second and the sixth years will be carried out at the discretion of the District Forest Officer.

294. *Tending of the old timber coupes.*—When this plan comes into operation there will be twelve old coupes, ranging in age from 1 to 12 years, which will be tended more or less on the same lines as the coupes to be regenerated during the period of the plan but, as the coupes are incompletely stocked with the more valuable species and contain a great deal of inferior coppice, certain modifications in the tending will be necessary. The coupes that are five years old and under will be tended twice, while the coupes that are from 6 to 12 years old will be tended only once during the period of the plan. The tending will be carried out as follows :—

(1) *First tending.*—Old coupes VIII to XII, ranging in age from 1 to 5 years will be tended on the following lines :—

(*a*) All climbers will be cut.

(*b*) The coupe will be cleaned, favouring teak and the three auxiliary species.

If the youngest coupe was taken up for tending first, the oldest of the five coupes would be ten years old when tended, and it will not be convenient to tend more than one of these five coupes each year. Consequently the oldest coupe will be taken up first, and all these coupes will be five years old when first tended.

(2) *Second tending.*—The coupes that are from 6 to 12 years old are badly in need of tending. The oldest coupe will be taken up first, so that all these seven coupes will be tended when they are twelve years old. The youngest coupes will receive the second tending when they are 10 years old. The second tending will be carried out as follows :—

(*a*) Climbers will be cut.

(*b*) The coupe will be cleaned.

(*c*) The coppice poles of teak and the auxiliary species will be thinned wherever it is silviculturally desirable.

295. *Tending of the intermediate compartments.*—Climber-cutting will be carried out in the intermediate compartments on a five-year cycle, the work being done twice during the period of this plan. For the purpose of climber-cutting coupes VI to X are included in the intermediate compartments for the first cycle only.

296. *Tabular statements.*—The following statements show the work to be done each year and the operations to be carried out each month.

ANNUAL CALENDAR OF WORKS FOR THE TIMBER CLEAR-FELLING WORKING CIRCLE.

Year.	Areas to be demarcated.			Coupe for preliminary climber cutting.		Areas to be felled.		Areas to be regenerated.		Tending of new coupes.				Tending of old coupes.				Intermediate Compartments for climber-cutting.		Remarks.
										First year after regeneration.		Sixth year after regeneration.		First tending.		Second tending.				
	Coupe number.	Compartment.	Length of line.	Number.	Area.	Coupe number.	Area.	Coupe number.	Area.	Number.	Area.	Number.	Area.	Number.	Area.	Number.	Area.	Number.	Area.	
(1)	(2)	(3)	(4) M. F. CH.	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
								A. BEDDADANOLE FELLING SERIES.												
1934–35	II	9 except coupes I and IV.	5 1 7	II	34	I	33	..	..	..	..	..	..	VIII	56	I	50	1, 5, 6 and 8 except coupes I to X.	168	1. The old timber coupes are distinguished by the numbers being underlined. 2. For the purpose of this statement regeneration includes: lining out, cutting back, burning, staking, stumping, weeding and replacement of casualties. 3. Tending of the coupes between the second and sixth year after regeneration will be carried out by the District Forest Officer in accordance with the silvicultural requirements of the crop.
1935–36	III	10, 11, 12, 13 except coupe III, 14.	6 2 9	III	35	II	34	I	33	..	..	..	..	IX	55	II	52	9, except coupes I and IV.	177	
1936–37	IV	15 except coupe V, 16, 17 and 18 except coupes XI and XII.	4 7 9	IV	33	III	35	II	34	I	33	..	..	X	40	III and III-a	64	10, 11, 12, 13 except coupe III and 14.	166	
1937–38	V	21, 25, 26, 28, 29 and 32 to 35.	7 0 9	V	34	IV	33	III	35	II	34	..	..	XI	53	IV	49	15 except coupe V, 16, 17 and 18 except coupes XI and XIII.	170	
1938–39	VI	....	0 7 3	VI	34	V	34	IV	33	III	35	..	..	XII	50	V	56	21, 25, 26, 28, 29, 32 to 35.	153	
1939–40	VII	....	0 3 0	VII	33	VI	34	V	34	IV	33	..	..	..	..	VI and VIII	118	1, 5, 6 and 8 except coupes I to X.	168	
1940–41	VIII	....	0 1 2	VIII	33	VII	33	VI	34	V	34	I	33	..	..	VII and IX	96	9 except coupes I, IV, VII and X.	111	
1941–42	IX	....	..	IX	34	VIII	33	VII	33	VI	34	II	34	..	..	X	40	10, 11, 12 and 14 ..	132	
1942–43	X	....	0 2 6	X	33	IX	34	VIII	33	VII	33	III	35	..	..	XI	53	16, 17, 18 except coupes XI, XII and VIII.	103	
1943–44	..	....	..	..	..	X	33	IX	34	VIII	33	IV	33	..	..	XII	50	21, 25, 26, 28, 29, 32 to 35.	153	
								B. PULIRAMUDUGUDEM FELLING SERIES.												
1934–35	II	8, 9 south of old fuel coupes I and II.	2 1 8	II	24	I	24	..	..	..	..	..	..	VI	28	I and I-a	25	1, 2 except coupes II and V, 3, 4 except coupes I and I-*a*, 5 and 7.	159	
1935–36	III	9 balance, 10, 11 and 12.	4 5 7	III	24	II	24	I	24	..	..	..	..	VII	34	II	31	8, 9 south of coupes I and II.	176	
1936–37	IV	18, except coupes I and IV, 19 and 20 except coupe III.	3 3 9	IV	24	III	24	II	24	I	24	..	..	VIII	20	III	20	9 balance, 10, 11 and 12.	143	
1937–38	V	21 to 26	4 3 1	V	24	IV	24	III	24	II	24	..	..	IX	23	V and V-a	34	18 except coupes I and IV, 19, 20 except coupe III.	198	
1938–39	VI	....	0 1 9	VI	26	V	24	IV	24	III	24	..	..	X	23	..	..	21 to 26	227	
1939–40	VII	....	0 2 3	VII	24	VI	26	V	24	IV	24	..	..	..	..	VI	28	1, 2 except coupes II and V, 3, 4 except coupes I and I-*a*, 5, 7.	159	
1940–41	VIII	....	0 2 8	VIII	24	VII	24	VI	26	V	24	I	24	..	..	VII	34	8, 9 south of old fuel coupes I and II.	176	
1941–42	IX	....	0 2 2	IX	25	VIII	24	VII	24	VI	26	II	24	..	..	VIII	20	9 balance, 10, 11 and 12.	143	
1942–43	X	....	..	X	24	IX	25	VIII	24	VII	24	III	24	..	..	XI	23	18 except coupes I, IV, VI, VIII and IX, 19, 20 except coupes III, VII and X, 21 and 22.	196	
1943–44	..	....	..	..	..	X	24	IX	25	VIII	24	IV	24	..	..	X	23	23 to 26	106	

MONTHLY CALENDAR OF OPERATIONS FOR THE TIMBER CLEAR-FELLING WORKING CIRCLE.

April	(1) The coupes of the year will be handed over to the contractors for felling. (2) Any unfelled areas in the coupes of the previous year will be felled departmentally. (3) Tending of coupes the sixth year after regeneration.
May	(1) Lining-out, cutting-back, and burning the areas to be regenerated. (2) Tending of coupes the year after regeneration.
June	(1) Staking the coupes to be regenerated. (2) Stumping the same areas if the monsoon is favourable.
July	(1) Complete stumping teak in the areas to be regenerated if not completed in June. (2) In 1934–35 only—demarcation of compartments for climber-cutting during the year.
August	(1) First weeding in the coupe under regeneration. (2) Replacement of casualties in the same area.
September	Climber-cutting in intermediate compartments.
October and November ..	No special work as these months are particularly malarial.
December	(1) Second weeding and working up soil in the coupes under regeneration. (2) Fire protection operations will commence.
January	Fire protection operations will be completed.
February	Demarcation of coupes and compartments to be worked during the next year.
March	(1) Demarcation will be completed. (2) Preliminary climber-cutting in the coupes to be felled following month.

SECTION 9.—MISCELLANEOUS REGULATIONS.

297. *Demarcation.*—It will not be possible to demarcate all the compartments in one year, for this will be more than can be done by the district staff. It will suffice if the compartments to be tended, and the coupes to be felled, are demarcated in February and March the year before they are worked, except in 1934–35, when the compartments for climber-cutting in August will have to be demarcated in July. The areas to be demarcated each year are shown in the Annual Programme of Works.

298. *Fire protection.*—Fire is a serious menace, particularly in the Beddadanole felling series, and the regenerated areas must be carefully protected against fire. Two forms of protection have been adopted :—

A. Indirect protection.—The sequence of the coupes on the ground has been broken for the purpose of keeping down grass, which comes in rapidly if adjacent areas are clear-felled. This reduces the risk from fire, facilitates tending, and lessens the damage done, if the coupe happens to catch fire.

B. Direct protection.—(*a*) A system of permanent fire lines has been marked on the working plan maps. The exterior lines will be 50 feet wide and the interior lines will be 25 feet wide. Guide lines 5 feet wide will be cut on each side of the fire lines and the whole width will then be burnt clean.

(*b*) The coupes that will be regenerated under this plan will be specially protected by fire-tracing a strip 100 feet wide all around the regenerated area. This will be continued throughout the period of the plan.

299. *Protection against grazing.*—All the old coupes and all areas regenerated under this plan will be permanently closed to grazing. This will cause no hardship or serious inconvenience. As the regenerated areas are scattered, there may be some difficulty in effectively protecting the coupes, nevertheless, complete closure to grazing is necessary ; and it will be left to the District Forest Officer to adopt suitable measures to meet any difficulties that may arise in ensuring complete closure to grazing.

SECTION 10.—CONTROL.

300. The following control forms will be maintained :—

(1) The Control Book,
(2) The Record of Works,
(3) The Control Journal,
(4) The Control Map, and
(5) The Record of Deviations.

Sample forms of the control book, and the record of works will be found in Appendix VIII.

CHAPTER VI.—WORKING PLAN FOR THE PAPIKONDA EXPERIMENTAL WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION OF THE WORKING CIRCLE AND CHARACTER OF THE VEGETATION.

301. *General constitution of the working circle.*—The timber areas situated in the eastern half of Papikonda reserve, and the north-east quarter of Kovvada block II, which contain teak, rosewood, *Terminalia tomentosa*, *Pterocarpus marsupium* and other saleable timber, in sufficient quantity to ensure profitable working, have been grouped together to form the Papikonda Experimental Working Circle.

302. *General character of the vegetation.*—The forests included in this working circle have been described in detail in paragraphs 54 to 58 of Part I of this plan. They consist of patches of teak and other saleable timber, of varying density and quality, standing in a forest of bamboo and inferior deciduous species in which bamboo alone is saleable. Teak, the principal species, occurs in irregularly distributed patches, chiefly on flat or gently sloping ground, and wherever it occurs it predominates. There are extensive areas containing no teak, and the crop is generally mature or over-mature. The mature groups of teak and its associate species are producing no regeneration, and in parts are being invaded by *Xylia xylocarpa*. The crop is probably putting on very little increment, and the early removal of the mature and over-mature timber is desirable.

SECTION 2.—PERMANENT DIVISION INTO BLOCKS AND COMPARTMENTS.

303. *Forest blocks.*—The patches of timber forest that form the working circle are situated in parts of Papikonda reserve and Kovvada block II. The area located in each reserve is comparatively small and it is unnecessary to sub-divide it into separate forest blocks.

304. *Compartments.*—The teak areas are located at the northern and southern ends of the working circle. The northern teak group comprises four separate patches situated on the slopes running down to the Godavari, and a large patch in the eastern half of the Ravigudem valley between the Tenakonda saddle and the Pata Vagu. Each patch will form a separate compartment. The teak forest in the north-east quarter of Kovvada block II is divided into two more-or-less equal parts by the Sengal Kalava, and each part forms a separate compartment. The patch of teak at the southern extremity of Papikonda reserve adjoining the Kovvada block has been combined with the patch of miscellaneous timber lying between it and Gampa Vagu to form a composite compartment in which the teak and miscellaneous forests form separate sub-compartments. The mixed timber forests, which contain no workable teak, comprise two large patches : one is situated to the east of the Ravigudem-Chilakalur footpath between the Pata Vagu and the Gampa Vagu linking the northern with the southern teak compartments ; the other is an irregular patch situated west and north-west of Papikonda extension reserve, in the country drained by the upper reaches of the Pata Vagu and its feeder the Osur Kalava. Each forms a separate compartment. Finally, there is a small patch of timber adjoining the north-west boundary of the Revigudem enclosure which forms a small compartment containing about five per cent of teak. In all there are eleven compartments : seven teak, two miscellaneous,

and two composite. The teak compartments cover about three-fifths of the area of the Papikonda Experimental Working Circle. The following statement shows the area and distribution of the compartments :—

Distribution and area of timber compartments in the Papikonda Experimental Working Circle.

Compartment number. (1)	Type of growth. (2)	Description. (3)	Area in acres. (4)
1	Teak and its associate species.	A narrow strip along the northern boundary of Papikonda reserve between Korattur and Sivagiri.	142
2	Do.	The Balli Konda ridge and the adjoining slopes in the north-east corner of Papikonda reserve.	138
3	Do.	The angle of Papikonda reserve and a narrow strip along the boundary line, west and south-west of Chidur.	65
4	Do.	The upper northern slopes of Papikonda reserve adjoining the Addakonda-Potanakonda ridge.	245
5	Do.	The Ravigudem valley between the Tena Konda saddle and the Pata Vagu excluding the poor growth on the slopes of the Tena Konda ridge, on Muchu Konda, and along the eastern boundary of Papikonda reserve.	732
6	A mixed crop of *Terminalia tomentosa, Pterocarpus marsupium, Xylia xylocarpa* with a little teak and rosewood.	A plot about 35 chains long and 20 chains broad bordering on the north-west boundary of the Ravigudem enclosure.	67
7	Mixed timber, as in compartment 6, without teak.	A large irregular plot about 140 chains long, with a mean width of about 22 chains, running in a general north-easterly direction from the Daravada enclosure. The boundaries of the compartment follow the contours at the limit of the timber belt.	606
8	Do.	The part of Papikonda reserve lying between the Pata Vagu and the Gampa Vagu, east of the Chilakalur-Ravigudem footpath.	606
9	Sub-compartment 9-a contains mixed timber without any teak. Sub-compartment 9-b contains teak and its usual associates.	The part of Papikonda reserve south of the Pata Vagu and east of a line running more or less parallel to the Chilakalur-Kotrupalli footpath, excluding the poor growth on the slopes of Kontula Konda. The area is divided into two sub-compartments : 9-a—152 acres—north-east of the Chilakalur-Ginnapalli path, and 9b—188 acres—forming the remainder of the compartment.	340
10	Teak and its usual associates.	The north-east corner of Kovvada block II between the Totagandi Vagu, the Sengal Kalava, and the south-east boundary of the Kotrupalli enclosure.	380
11	Do.	A plot about 110 chains long and 35 chains wide south of the Sengal Kalava and the Totagandi Vagu, the western and eastern boundaries of the compartment being feeders of these two streams, and the southern boundary a cut line more or less parallel to the northern boundary.	382
		Area of working circle ..	3,703

SECTION 3.—ANALYSIS AND VALUATION OF THE GROWING STOCK.

305. *The necessity for analysis of the growing stock.*—Except compartment 1 and the lower slopes of compartment 3 which are within easy reach of the Godavari, all the areas forming the working circle are situated on the terraces and gentle slopes of Papikonda reserve and Kovvada block II, at elevations ranging from about 1,000 feet to 1,600 feet above mean sea-level. The most convenient outlet for the timber from these areas lies along the steep northern slopes of Papikonda reserve running down to the Godavari. These slopes are strewn with large boulders and contain numerous out-crops of sheet rock, making road construction difficult and expensive ; and at present there is no means of extracting timber from the plateau at a reasonable cost. If the timber forests are to be worked at a profit it will be necessary to construct one or more timber skid-ways on the slopes down to the river, and a system of feeder roads to connect the timber coupes with the skid-ways. Therefore it was necessary to ascertain what quantity of teak, and other saleable timber was available for extraction, in order to determine the expenditure that might justifiably be incurred on the extraction scheme. For this purpose all the timber-bearing areas in Papikonda reserve and Kovvada block II were located, surveyed and enumerated.

306. *Enumeration of the growing stock.*—Eleven plots of timber were enumerated ranging in area from 65 acres to 1,222 acres, the total area enumerated being 4,138 acres. Five plots with an aggregate area of 965 acres were completely enumerated, and six plots with an aggregate area of 3,173 acres were partially enumerated at $33\frac{1}{3}$ per cent. At first only the small plots were completely enumerated, but later it was found necessary to enumerate completely all plots in which the distribution of teak was markedly irregular. The crop was enumerated in 4-inch classes down to a diameter of four inches, an eye estimate being made of the workable length of bole ; and separate figures were recorded for teak, rosewood, *Terminalia tomentosa*, *Pterocarpus marsupium*, *Xylia xylocarpa* and *Anogeissus latifolia*, all other saleable species being grouped together in one class.

307. *Estimate of the quantity of timber in the enumerated areas.*—In order to convert the cylindrical volumes obtained from the enumeration figures into quantities of timber measured under bark, form-factors were worked out for each species on the formula :—

$\frac{\text{Sectional area under bark at mid-length of workable bole}}{\text{Sectional area over bark at breast height}}$ in the manner described in Part I, Chapter VI ; and the quantities were computed by the formula :—

Sectional area at breast height × length of workable bole × form-factor, the form-factors for the principal species being—

Teak	·55
Rosewood	·57
Terminalia tomentosa	·52
Pterocarpus marsupium	·59
Xylia xylocarpa	·58
Anogeissus	·65

Later the enumerated plots were formed into compartments, and in doing so the teak areas were separated from those containing no teak, all unworkable areas were excluded and the boundaries were improved. An estimate of the quantity of timber in each compartment, and an analysis of the enumerations will be found in the following statements :—

(1) *Estimated quantities and distribution of timber in the Papikonda Experimental Working Circle.*

Compartment number. (1)	Area. (2)	Teak. (3)	Rosewood. (4)	*Terminalia tomentosa.* (5)	*Pterocarpus marsupium.* (6)	*Xylia xylocarpa.* (7)	*Anogeissus latifolia.* (8)	Miscellaneous timber. (9)	Totals. (10)
	ACRES.	C.FT.	C.FT.	C.FT.	C.FT.	C.FT.	C.FT.	C.FT.	C.FT.
1 ..	142	13,200	121	5,216	1,653	1,304	5,560	3,129	30,183
2 ..	138	23,524	2,182	5,145	3,756	4,657	7,080	9,797	56,141
3 ..	65	951	148	393	76	117	1,514	716	3,915
4 ..	245	51,022	9,679	14,637	3,586	3,906	11,407	7,498	101,735
5 ..	732	62,638	16,210	32,622	10,793	14,360	53,972	21,948	212,543
6 ..	67	1,242	1,275	8,456	2,585	3,407	5,124	4,337	26,426
7 ..	606	Nil	5,108	33,013	24,168	100,362	28,858	35,024	226,533
8 ..	606	Nil	9,596	33,064	10,170	8,760	63,350	23,568	148,508
9 ..	340	21,432	2,333	4,608	2,484	1,743	8,352	4,505	45,457
10 ..	380	46,456	3,499	10,212	2,109	2,532	12,760	10,671	88,239
11 ..	382	37,768	4,865	16,180	3,432	1,848	25,261	10,005	99,359
Total ..	3,703	258,233	55,016	163,546	64,812	142,996	223,238	131,198	1,039,039

(2) *Species abstract.*

Species.	Under 12″ in diameter.				Over 12″ in diameter.				Total.	
	Number of trees.	Per cent.	Volume.	Per cent.	Number of trees.	Per cent.	Volume.	Per cent.	Number of trees.	Volume.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Teak	26,533	74	100,601	39	10,179	26	157,632	61	36,712	**258,233**
Rosewood	8,364	81	27,596	50	1,943	19	27,420	50	10,307	**55,016**
Terminalia tomentosa	11,216	63	47,428	29	6,500	37	116,118	71	17,716	**163,546**
Pterocarpus marsupium ..	4,775	66	20,517	32	2,445	34	44,295	68	7,220	**64,812**
Xylia	24,909	88	93,145	65	3,414	12	49,851	35	28,323	**142,996**
Anogeissus	23,068	77	106,525	48	6,958	23	116,713	52	30,026	**223,238**
Miscellaneous	14,582	77	47,770	36	4,428	23	83,428	64	19,010	**131,198**
Total ..	113,447	77	443,582	42	35,867	23	595,457	67	**149,314**	**1,039,039**

(3) *Distribution and Estimated yield of Teak.*

Compartment number.	Area in acres.	Estimated quantity of teak (c.ft.)		Mean quantity per acre (c.ft.)	
		Total.	Over 12 inches in diameter.	Total.	Over 12 inches in diameter.
(1)	(2)	(3)	(4)	(5)	(6)
1	142	13,200	8,609	93	61
2	138	23,524	12,100	178	90
3	65	951	44	15	1
4	245	51,022	36,529	208	149
5	732	62,638	44,173	86	60
6	67	1,242	873	19	13
7	606	Nil.	Nil.	Nil.	Nil.
8	606	Nil.	Nil.	Nil.	Nil.
9a	152	Nil.	Nil.	Nil.	Nil.
9b	188	21,432	11,058	114	59
10	380	46,456	20,009	122	53
11	382	37,768	24,237	99	63
Total	**3,703**	**258,233**	**157,632**	**70**	**43**

(4) *Analysis of Principal Species.*

Diameter class.	Number of trees.	Estimated quantity of timber (under bark).	Average yield per tree (under bark).
(1)	(2)	(3)	(4)
		C.FT.	C.FT.
TEAK.			
4″ to 8″	12,101	19,943	1·6
8″ to 12″	14,432	80,658	5·6
12″ to 16″	7,943	98,891	12·6
16″ to 20″	1,859	43,963	26·5
20″ to 24″	318	12,048	37·9
Over 24″	59	2,730	46·3
ROSEWOOD.			
4″ to 8″	4,637	7,601	1·6
8″ to 12″	3,727	19,995	5·4
12″ to 16″	1,467	17,095	1·6
16″ to 20″	391	7,706	19·7
20″ to 24″	73	2,104	28·8
Over 24″	12	515	43·0
TERMINALIA TOMENTOSA.			
4″ to 8″	4,310	7,435	1·7
8″ to 12″	6,906	39,993	5·8
12″ to 16″	4,506	59,158	13·1
16″ to 20″	1,514	36,572	24·2
20″ to 24″	356	13,670	38·4
Over 24″	124	6,718	54·2
PTEROCARPUS MARSUPIUM.			
4″ to 8″	2,032	3,793	1·8
8″ to 12″	2,743	16,724	6·1
12″ to 16″	1,839	25,345	13·8
16″ to 20″	459	11,936	26·0
20″ to 24″	107	4,599	43·0
Over 24″	40	2,415	60·4
XYLIA XYLOCARPA.			
4″ to 8″	13,413	25,478	1·9
8″ to 12″	11,496	67,667	5·9
12″ to 16″	3,117	41,789	13·4
16″ to 20″	263	6,480	24·6
20″ to 24″	34	1,582	46·5
Over 24″	Nil.	..	..

308. *Valuation of the growing-stock.*—No attempt has been made to estimate the present value of the growing-stock. There are so many unknown factors that this is beset with difficulties, and the result would not be accurate enough to be of any practical value. For the purposes of the extraction scheme it has been estimated that the value of the teak after deducting the cost of extraction, interest and other charges will be about 10 annas a cubic foot. The annual coupes are expected to yield about 10,000 cubic feet of teak, and about the same quantity of timber of other species, consequently, if the estimates are correct, the value of the standing timber in a coupe will average about Rs. 8,000 or approximately Rs. 40 per acre. This is a conservative estimate.

SECTION 4.—METHOD OF TREATMENT.

309. *Facts influencing the management.*—The teak forests of this working circle are like the better parts of the Timber Clear-felling Working Circle, except that the stands are denser and the trees attain larger dimensions. Silviculturally they are amenable to the same method of treatment, but the following factors bear on the management to preclude the inclusion of these forests in the Timber Clear-felling Working Circle :—

(1) Almost the entire working circle is situated above ghauts at a mean elevation of about 1,000 feet above the Godavari river ; and as there is no road to the river, transportation is difficult, and prohibitively expensive. If the forests are to be worked regularly, it will be necessary to construct roads, or other means of communication linking the working circle with the river ; and the quantity of timber extracted each year must be large enough to justify the expenditure on the extraction scheme.

(2) Labour is very scarce in the neighbourhood of Papikonda reserve and Kovvada block II ; and although bamboo working is well established on the plateau, large areas in the interior remain untouched for want of sufficient labour. Therefore it will be necessary to import labour to exploit and regenerate the timber areas. The forests are very malarial and have acquired an evil reputation throughout the district, influenced to a certain extent by local superstition ; consequently it will not be easy to recruit an efficient labour force and maintain it in a reasonable state of health and contentment. This is by no means an insuperable difficulty, but it would be a mistake to assume that it is not difficult. In any event the labour force is an unknown factor, and it is necessary to take cognizance of this in drawing up a working plan for these forests.

310. *The extraction scheme.*—It has long been recognized that the forests cannot be worked for timber until the transport problem has been solved ; and during the past ten years somewhat desultory efforts have been made to find a suitable means of linking the Papikonda plateau with the Godavari river. The lowest point on the edge of the plateau is just over a mile in a bee-line to the river, and about a thousand feet above it. The configuration of the ground presents no great difficulty, but the slopes down to the river contain numerous out-crops of rock, and the surface is broken and strewn with boulders in parts, making road construction difficult, and more expensive than the purpose warrants. During the preparation of the working plan the transportation problem was investigated once again by the Forest Engineer and an extraction scheme was prepared on the following lines :—

(1) A main unmetalled road will be constructed on the plateau from the Tena Konda saddle to compartment 11 in Kovvada block II, a distance of 8 miles.

(2) Temporary feeder roads will be constructed to link the timber coupes with the main road.

(3) A timber skid-way will be constructed from the end of the main road at the Tena Konda saddle down the slopes to the Godavari. The gradient will be regulated to check acceleration, and it will be necessary to work the logs down to the river.

(4) The extraction scheme covers compartments 5 to 11, and so these areas alone will be worked during the period of this working plan. Thereafter a separate scheme will be drawn up for extracting the timber from compartments 1 to 4.

(5) The entire road system will not be taken up at once, but construction will proceed from the Tena Konda saddle towards Kovvada block II along with the fellings ; and it is expected that the skid-way and part of the road system will be complete in 1935 so that fellings may commence in 1936.

(6) The capital cost of the extraction scheme is estimated to be Rs. 15,000 ; while maintenance, and interest charges are expected to cost about Rs. 2,300 per annum.

311. *The economic position.*—The system of extraction has a direct bearing on the management of these forests. At present the growing stock does not justify the construction of anything more expensive than a timber skid-way down the steep slopes to the Godavari. The skid-way will probably be subjected to heavy deterioration, wear and tear ; large quantities of timber will be required for its construction and maintenance ; and the enumeration figures indicate that it will not be long before the supplies of suitable material within easy reach begin to fail, and then it will be difficult to maintain the skid-way at a reasonable cost. At its best the skid-way is only a temporary device : it cannot be expected to work efficiently throughout the rotation. Therefore, from a purely economic point of

view, it is desirable to work out all the saleable material from the areas tapped by the skid-way as rapidly as possible, and then to construct suitable skid-ways for compartments 2 and 4, working them on the same lines. There is no fear of glutting the Rajahmundry market, and with the mature and over-mature stock deteriorating, the fire menace ever present, and the future means of extraction obscure, a ton of timber on the river bank is well worth two tons to be collected from the Papikonda plateau during the period of the rotation. But these considerations clash with the main principles of forest management; and it is necessary to examine the silvicultural position before deciding on the method of treatment.

312. *The silvicultural position.*—The silvicultural position is summarized below :—

(1) The description of the growing-stock and the summary of the enumerations have shown that the working circle is by no means rich in teak : two large compartments and one sub-compartment contain no teak ; and the estimated quantity in the teak compartments averages above two tons per acre, of which about a ton and a quarter is over 1 foot in diameter. The teak is not evenly distributed throughout the compartments, but is concentrated on the lankas, which contain a well-stocked even-aged crop, generally over-mature, mature, or approaching maturity. The teak lankas are surrounded by open mixed deciduous forest and bamboo in which there is some inferior teak, with large patches containing no teak. Almost everywhere regeneration of teak and the more valuable associate species is wanting ; and in parts of the working circle where fire-protection has been effective—notably compartment 5—*Xylia xylocarpa* is invading the lankas.

(2) The compartments which contain no teak vary greatly in quality. The most valuable species in these compartments are *Terminalia tomentosa, Pterocarpus marsupium, Adina cordifolia,* and some scattered rosewood of small dimensions. These species are generally mature or over-mature and are producing no regeneration. *Xylia xylocarpa* is the only active species of any value, it regenerates freely and is spreading rapidly. Parts of compartment 7 are already in an advanced stage of transition from a mixed deciduous forest of *Terminalia tomentosa, Pterocarpus marsupium*, etc., to a *Xylia* forest associated with inferior evergreen species, and the removal of the mature overwood is desirable.

(3) The most suitable silvicultural treatment for the teak lankas is clear-felling, with regeneration obtained either on the Walayar method, or by complete planting. The teak forests outside the lankas can best be treated on selection lines, regeneration being left to nature—the artificial regeneration of these areas is desirable but not feasible. In the compartments that contain no teak, regeneration presents no difficulty, as there is already a great deal of advance growth of *Xylia*, and this species will soon take possession of the gaps created by fellings. The correct silviculture appears to be to remove all mature and over-mature timber by selection fellings in single trees or groups. This will assist the transition now in progress in compartment 7 and will promote the spread of *Xylia* in compartment 8. There are no pole crops in need of tending and climbers are very destructive in parts of compartments 4, 5, 6, 7 and 8.

313. *The management difficulties.*—At present we know nothing about the labour force that will be available for working these forests ; the skid-way has not been proved to be an efficient and economical device for extracting heavy round timber ; and the possibility of carting on the plateau has not been investigated. As the working of these forests will be more or less experimental for many years, it will suffice if the working plan sketches the broad outlines of management leaving the details to be filled in by the District Forest Officer on experience gained as work progresses. The chief difficulty is to arrive at a method of treatment which will ensure a sustained yield, meet the silvicultural requirements of the growing stock, satisfactorily regenerate the areas felled each year, and at the same time produce an outturn of timber large enough to justify the expenditure on the extraction scheme. The teak forests on the lankas of Papikonda reserve and Kovvada block II can grow teak up to about 4 feet in girth on a rotation of about 70 years. The total area under teak is about 2,300 acres, of which only about 1,200 acres will be suitable for clear-felling and concentrated regeneration. If these forests were worked on the same lines as the Timber Clear-felling Working Circle, the area to be felled each year would be only about 17 acres. The mean yield of teak over 12 inches in diameter per acre for all the teak compartments has been estimated to be about a ton and a half per acre, and assuming that the yield from the areas fit for concentrated regeneration were twice this figure, the outturn per annum would be only 51 tons, or approximately 2,500 cubic feet. This would not justify the extraction scheme. If the forests were worked on the group selection method it would be equally difficult to obtain a sustained yield, satisfactorily regenerate the gaps, and at the same time

extract the required quantity of timber. Apart from this, it must be remembered that about two-thirds of the teak in this working circle is mature, over-mature, fire-scarred or otherwise damaged. It is producing no regeneration, very little increment, and the over-mature trees are decaying. It is silviculturally desirable that these mature trees should be removed as rapidly as possible and replaced by active young crops ; and if the timber can be transported to the river bank it will be snapped up by the Rajahmundry market. Therefore it is bad business to allow all this teak to run to rot merely because the forests cannot be worked on a regular silvicultural system ; and the correct management appears to lie in an effective compromise between the conflicting considerations which have just been discussed.

314. *Method of treatment.*—The teak compartments will be subjected to a different method of treatment from those that contain no teak.

A. *The teak compartments.*

All the mature, over-mature, dead and dying timber that is saleable will be removed during the period of this plan, from the teak compartments, that are tapped by the Forest Engineer's extraction scheme ; and as large an area as possible will be artificially regenerated during this period. Compartments 5, 9 *b*, 10 and 11 have been divided into eight coupes, each of which is expected to yield a little over 10,000 cubic feet of teak over 12 inches in diameter. The plots suitable for concentrated regeneration in each coupe have been marked on the working plan map, and the District Forest Officer will personally select the area to be clear-felled and artificially regenerated, within the limits of these plots. If other considerations permit it, the areas selected for concentrated regeneration in adjoining coupes should be contiguous : this will facilitate protection against grazing and fire, and general control. No definite area is prescribed for clear-felling as this will depend on the labour available and other factors. It will be as large an area as the District Forest Officer will be able to regenerate artificially during the year. The areas selected for clear-felling will be in the heaviest stands of teak, and will provide the cream of the yield. The rest of the coupe will be worked by selection fellings, removing all saleable mature, over-mature, dead and dying timber. For the purpose of this rule maturity is defined as all teak over 12 inches in diameter, and all other species over 16 inches in diameter.

B. *The compartments that contain no teak.*

As the teak compartments contain a considerable quantity of *Terminalia tomentosa*, *Pterocarpus marsupium* and other miscellaneous timber—probably as much as can be extracted and sold during the year, it has been considered inadvisable to lay out a series of coupes in the compartments that contain no teak. These areas will constitute a reserve timber supply to be worked at the discretion of the District Forest Officer whenever the demand justifies such working. Compartment 8 lies astride the main road, and the other compartments are within easy reach, so that there will be no difficulty in tapping these areas. The necessary quantity of timber will be removed by selection fellings of mature, over-mature, dead and dying trees, preferably in groups over advance growth. For this purpose maturity is defined as all growth over 16 inches in diameter. The trees for removal will be marked silviculturally so that the fellings may benefit the crop as much as possible. The order of felling, and other details will be prescribed by the District Forest Officer.

315. *Regulation of the yield.*—The yield will be prescribed and regulated by area.

SECTION 5.—METHOD OF EXECUTING THE FELLINGS.

316. *Felling rules.*—Until the coupes can be sold standing to contractors the fellings will be carried out departmentally. The only felling rules are :—

(1) In the plots selected for clear-felling and concentrated regeneration, all growth will be felled whether saleable or not, and a strip 30 feet wide will be clear-felled around the plot to reduce the side shade, and serve as a fire line.

(2) Selection fellings will be carried out with care so that the felling trees may do as little damage as possible.

If additional felling rules are found to be necessary they may be prescribed by the District Forest Officer.

SECTION 6.—TABULAR STATEMENT OF FELLINGS.

317. *Allotment of coupes.*—Coupes have been allotted for the period of the working plan as shown in the following statement :—

Tabular statement of fellings for the Papikonda Experimental Working Circle.

Year of felling.	Coupe number.	Compartment number.	Area in acres. Fit for concentrated regeneration.	 Other areas.	 Total.
(1)	(2)	(3)	(4)	(5)	(6)
1936–37	I	5	63	125	188
1937–38	II	5	85	48	133
1938–39	III	5	65	73	138
1939–40	IV	5	84	189	273
1940–41	V	9 *b*	77	111	188
1941–42	VI	10	164	104	268
1942–43	VII	11	60	142	202
1943–44	VIII	11	84	96	180
		Total acres ..	**532**	**888**	**1,420**

NOTE.—(1) Fellings will not commence until 1936 as the skid-way and roads will not be ready until the end of 1935.

(2) The areas fit for concentrated regeneration have been marked on the working plan maps.

SECTION 7.—SUBSIDIARY SILVICULTURAL REGULATIONS.

A. Regeneration.

318. *Regeneration of the clear-felled plots.*—The District Forest Officer will be responsible for the satisfactory regeneration of all plots that are clear-felled under the prescriptions of this chapter. As these plots will be selected within the suitable area marked on the working plan map, and will be located in the best teak stands, the suitability of the soil for planting teak is more or less safeguarded, and there should be no failures on this account. If the clear-felled plots were regenerated on the Walayar system, as in the Timber Clear-felling Working Circle, the greater part of the teak coppice would be derived from over-mature stools and would not be worth retaining ; while in coupes I and IV, where there is likely to be a heavy crop of weeds, it would be necessary to plant up the entire plot, using the teak coppice as additional cover against weeds, and cutting it back when it is likely to suppress adjoining plants. Thus, in practice, the Walayar method would probably dissolve into straight forward planting. No risks can be taken with the regeneration of the clear-felled plots : it is necessary that they should be fully stocked with a regular uniform teak crop. The best method of regeneration will be planting one year old teak stumps at an espacement of 6′ × 6′ over the entire clear-felled area, the coppice regrowth being utilized, regulated, or eradicated in accordance with the silvicultural requirements of the crop. Nursery practice and the preliminary work before planting will be carried out on the same lines as in the Timber Clear-felling Working Circle.

319. *Regeneration of the areas worked by selection fellings.*—During the period of this plan it will not be practicable to artificially regenerate the gaps caused by selection fellings. The position of the gaps will be marked on the working plan and control maps ; and observations on the natural regeneration of these gaps will be recorded in the control journal. The matter will be re-examined at the next revision of the working plan.

B. Tending.

320. *Weeding and cleaning.*—Weeding and cleaning of the regenerated areas will be carried out more or less on the same lines as in the Timber Clear-felling Working Circle, but the number and time of the weedings will not be prescribed, as no information is available to show what weeding will be necessary on the Papikonda plateau and in Kovvada Block II. In all probability coupes I to IV situated in compartment 5, will require more frequent weeding than coupes V to VIII situated at the southern end of the working circle. It will be the special responsibility of the District Forest Officer to see that the areas clear-felled and regenerated under this chapter are weeded and cleaned as frequently as is necessary for the proper growth and development of the young crop.

321. *Thinnings.*—In order to ensure that thinning will not be neglected it is prescribed that the regenerated plots, or plantations, will be inspected for thinning by the District Forest Officer when they are five years old, and annually thereafter until they are thinned, the reasons for postponing the thinning after each inspection will be recorded in the remarks column of the ‘ Record of Works.’ As only the first three coupes are likely to be thinned during the period of this plan it is unnecessary to prescribe for second or subsequent thinnings.

322. *Climbers.*—Large woody climbers such as *Butea superba* and *Bauhinia vahlii* do considerable damage in parts of the working circle, notably in compartments 4, 5, 6, 7 and 8 ; and it is desirable that they should be eradicated. For this purpose the areas that will be felled and regenerated during the period of the working plan need different treatment from those that will not.

323. *Preliminary climber cutting before felling.*—In March, a month before the coupe is felled, all climbers will be cut, not only in the area selected for concentrated regeneration, but throughout the coupe. It is particularly necessary to eradicate the large woody climbers *Butea superba* and *Bauhinia vahlii*, and as these climbers generally grow on soft soils where felling below ground is easy and cheap, the following method will be tried experimentally in the first two coupes :—

> The earth around the base of the stem will be excavated to permit of the climbers being felled from 8 to 9 inches below ground level. The cavities will then be filled with earth and tamped with the feet. If this method proves successful it will be continued ; if not, the District Forest Officer will try other means of eradication.

324. *Climber-cutting in the other compartments.*—If sufficient labour is available for this purpose climber-cutting will be carried out in compartments 4, 6, 7 and 8 during the period of this plan. This prescription must be kept in view and the work taken up as soon as possible. The District Forest Officer will draw up an annual programme of climber cutting, the area covered each year depending on the labour that is available for this purpose. It is suggested that the compartments should be worked in the following order : 4, 8, 7 and 6.

SECTION 8.—MISCELLANEOUS REGULATIONS.

325. *Demarcation.*—Although most of the compartment boundary lines are well marked natural features, boundary lines or foot-paths, still, it will not be possible, nor is it necessary, to demarcate all the compartments before fellings start. It will suffice if the following lines are cut to a width of 15 feet before the end of 1935 :—

(1) The southern, eastern and western boundaries of compartment 11.
(2) The line forming the north-west boundary of sub-compartment 9 *b*.
(3) The line forming the southern and eastern boundaries of compartment 5.

Thereafter, as labour is available, the compartments will be demarcated in the following order : 4, 3, 2, 1 and 6. The boundaries of compartment 8 are well-marked features ; and it is unnecessary to demarcate the contour line that forms the boundaries of compartment 7. The coupes will be demarcated before the end of January two months before felling, the coupe lines being of the standard width.

326. *Fire-protection.*—Fire is a serious menace, particularly in the Kovvada compartments, and all regenerated areas must be carefully protected. An exterior fire line, 50 feet wide will be cleared and burnt along the parts of the exterior boundary that are likely to be exposed to invading fires. This line has been marked on the working plan map. The coupe boundaries will be maintained throughout the period of the plan, and the 30-feet line surrounding the regenerated plots will be fire-traced annually.

327. *Protection against grazing.*—All coupes will be closed to grazing after felling and will remain closed to grazing throughout the period of this plan. There is not much grazing in Papikonda reserve and Kovvada Block II, and the closure will cause little inconvenience.

328. *L'envoi.*—Apart from the extraction and silvicultural problems that are involved, this working circle is of special interest because it is an attempt to open out and develop an area which has long been considered unworkable on account of malaria and the shortage of labour. Being more or less a pioneer venture, success will depend on faith, energy and good organization. And, although it is a comparatively small undertaking, it would be a mistake to underrate the difficulties that have to be faced, particularly in recruiting an efficient labour force and keeping it free of fever and reasonably contented. In organizing the labour very special care will have to be taken to keep the forest subordinates and coolies free of fever. The prophylaxis of malaria is well known, and the District Forest Officer will have to pay close personal attention to this matter. The skid-way and malaria will probably prove the crux of the undertaking.

SECTION 9.—CONTROL.

329. The following control forms will be maintained :—

(1) The Control Book,
(2) the Record of Works,
(3) the Control Journal,
(4) the Control Map and
(5) the Record of Deviations.

Sample forms of the control book and the record of works will be found in Appendix VIII.

CHAPTER VII.—WORKING PLAN FOR THE UPLAND COPPICE WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION OF THE CIRCLE AND CHARACTER OF THE VEGETATION.

330. *Constitution of the circle.*—The working circle comprises all the mixed deciduous forests of the Lower Godavari division that can be worked regularly for fuel. It has been called the Upland Coppice Working Circle to distinguish it from the mangroves that are worked for fuel along the coast. The working circle includes the fuel forests on the flat ground and lower slopes of Sudikonda, Tirumalayapalem, and Mallavaram reserves of Gokavaram range, and the two Devancheruvu blocks of Rajahmundry range. Dense bamboo forest, open scrub, all broken ground liable to erosion, and all hill slopes above the limit of economic exploitation, have been kept out of the working circle.

331. *Character of the vegetation.*—The vegetation has been described in detail in Part I, Chapter II. The fuel forests of Sudikonda, Tirumalayapalem and Mallavaram reserves include the types described in paragraphs 49 and 53 whereas the Devancheruvu blocks are described in paragraph 50. The Devancheruvu blocks consist chiefly of a low tangle of xerophytic species with no bamboo, and no growth capable of producing small timber, but being near Rajahmundry every stick is saleable. The rest of the area is typical fuel forest, with patches of good growth capable of yielding small timber and agricultural implements, and bamboo is plentiful. These forests are situated from 25 to 35 miles from the principal fuel markets.

SECTION 2.—PERMANENT DIVISION INTO BLOCKS AND COMPARTMENTS.

332. *Blocks and compartments unnecessary.*—The management does not necessitate the subdivision of the forests into blocks and compartments. The forest reserves being comparatively small serve the purpose of blocks ; and, in common with fuel forests that are worked as simple coppice, the coupe will serve as the unit of management.

SECTION 3.—SUBDIVISION OF THE WORKING CIRCLE.

333. *Sectors.*—The circumstances which justify the subdivision of a working circle into sectors have been discussed in paragraph 190, wherein a sector was defined as "part of a working circle in which the rotation has been altered or the silvicultural system modified to meet the special objects of management." It has already been pointed out that the growth in the two Devancheruvu reserves differs materially from that in the rest of the working circle ; and, although these forests are amenable to the same silvicultural treatment as the rest of the working circle, yet they have to be worked on a shorter rotation, and there are other minor modifications in the method of treatment. It has therefore been decided to subdivide the working circle into two sectors :—

	ACS.
The Sudikonda Sector with an area of	5,723·5
The Devancheruvu Sector with an area of	2,064·0
Area of the working circle	**7,787·5**

Each of these sectors will be subdivided into two or more felling series.

334. *Felling series, and reasons for their formation*—

A. The Sudikonda Sector.

The bulk of the produce from the Sudikonda Sector goes to Cocanada, Rajahmundry and Samalkot, but there is a local demand for small timber and agricultural implements which it is desirable to meet, encourage, and develop ; and for this purpose fellings will have to be made at several centres. Also, it is desirable to limit the size of the coupes to the requirements of the small fuel merchant, thereby increasing competition and raising the level of prices obtained for the coupes. Considering this, and the general convenience of keeping entire felling series in each reserve, it has been decided to subdivide the Sudikonda Sector into four felling series as shown below :—

Reserve. (1)	Felling series. (2)	Area in acres. (3)
Sudikonda	1 Sudikonda	1,834·5
Tirumalayapalem	1 Tirumalayapalem, North	1,223·5
	2 Tirumalayapalem, South	1,194·0
Mallavaram	1 Mallavaram	1,471·5
	Area of sector ..	**5,723·5**

B. The Devancheruvu Sector.

The Devancheruvu Sector consists of two small reserves ; one to the east and the other to the west of Devancheruvu village. The two reserves are at present being worked as separate felling series on a rotation of 25 years. The rotation was investigated and no change is necessary. If the two series were combined into one, the average area of a coupe would be about 80 acres, and as the coupes are worked intensively, it is desirable that they should be small. Also, if the coupes were combined, a half of each coupe would be under 25 years old when felled. It has therefore been decided to continue to work the sector in two felling series, namely :—

		ACS.
The Devancheruvu East Felling Series with an area of	..	765·0
The Devancheruvu West Felling Series with an area of	..	1,299·0
Area of sector	..	**2,064·0**

SECTION 4.—ANALYSIS AND VALUATION OF THE CROP.

335. *Analysis of the crop.*—Under the current working scheme there are seven fuel felling series in the neighbourhood of Sudikonda : two in Tirumalayapalem reserve, two in Sudikonda reserve, and three in Mallavaram reserve. These felling series have not been working satisfactorily for the following reasons :—

(1) Several coupes in Tirumalayapalem and Sudikonda reserves contain dense bamboo and very little fuel. Other areas, chiefly in Mallavaram reserve, contain large patches of broken ground and inferior scrub. These coupes are unsaleable.

(2) The maps on which the working scheme is based are very inaccurate. Consequently parts of coupes shown as flat ground on the map are actually on unworkable slopes, and the line marked on the map to delimit the height on the slopes to which fuel can be economically worked, occasionally runs up the slopes instead of following the contours.

(3) Finally, the computed areas are inaccurate.

Therefore, it was necessary to stock-map the accessible parts of Sudikonda, Tirumalayapalem and Mallavaram reserves in order to exclude all dense bamboo, broken ground, and inferior scrub, thereby ensuring that the areas included in the working circle are workable and well-stocked with fuel and small timber. The Survey of India, 2-inch topographical maps published in 1931 were used for this purpose, and were found to be accurate. The following statement compares the areas to be worked for fuel under this working plan with the areas included in the current felling scheme :—

Reserve.	Current felling scheme.		1934 working plan.	
	Number of felling series.	Area in acres.	Number of felling series.	Area in acres.
(1)	(2)	(3)	(4)	(5)
Sudikonda	2	2,700	1	1,834·5
Tirumalayapalem	2	3,300	2	2,417·5
Mallavaram	3	5,900	1	1,471·5
Total ..	**7**	**11,900**	**4**	**5,723·5**

It is hoped that the decrease in area will be counterbalanced by the increased value of the coupes. Some of the old coupes in the Mallavaram reserve will be suitable for inclusion in the working circle after a long period of rest. These areas have been marked on the working plan map. An analysis of the growing-stock is unnecessary in the Devancheruvu reserve.

336. *Valuation of the crop.*—No attempt has been made to value the growing-stock, as it is not possible to arrive at an accurate valuation with the data available ; and an arbitrary valuation serves no useful purpose. There will probably be an appreciable rise in the prices obtained for the coupes in the Sudikonda Sector as these coupes are now well-stocked ; but there will be no great change in the prices obtained for the Devancheruvu coupes.

SECTION 5.—METHOD OF TREATMENT.

337. *The silvicultural condition of the crop.*—(1) In the Sudikonda Sector the crop is composed chiefly of mixed deciduous coppice workable only for fuel, with groups of trees capable of yielding small timber and agricultural implements. These trees are not distributed evenly throughout the coupe but occur scattered and in patches only on the better soils. There are a few small blanks, and certain areas are incompletely stocked. Parts

of the forest have never been worked under regular fellings ; parts were worked as coppice with standards between 1908 and 1912 ; and the remainder of the crop has been worked as simple coppice partly on a 15 year's rotation, and partly on a rotation of 30 years. Coppice re-growth is good and there is a fair sprinkling of natural regeneration, but as the young coupes have not been suitably tended after felling, they are a mass of tangled thorny growth often difficult to penetrate. The chief silvicultural requirements are, protection of the young crop from climbers, control of the soft woods that tend to spread over the coupes after felling, and improvement of the composition and quality of the growing-stock by increasing the proportion of species that are suitable for small timber.

(2) In the Devancheruvu Sector the crop consists of a low dense tangle of growth in which xerophytic evergreen species predominate. It does not produce small timber and is worked solely for fuel. There are numerous small patches in which the crop is incomplete, but on the whole the coupes are well-stocked. Part of the forest was worked as coppice-with-standards from 1907 to 1912 ; part was worked as simple coppice on a rotation of 21 years, and since 1919 the forests have been worked as simple coppice on a rotation of 25 years. Coppice re-growth is good and there is a fair amount of natural regeneration, but some of the young coupes are over-run with climbers. The chief silvicultural requirements are protection against illicit hacking, and protection of the young coppice against climbers.

338. *Treatment necessary to improve the crop.*—In the Sudikonda Sector the growing-stock will be improved by tending the young coppice, and by rab sowings in suitable areas. There will be no rab sowings in the Devancheruvu coupes as they are more or less fully stocked, and no slash is available for burning as all produce obtained from the fellings is saleable. The young coupes will be protected against climbers and cleaned.

339. *The silvicultural system.*—As the forests are being managed for the production of small timber as well as fuel, the coppice-with-standards system naturally suggests itself. This system is unsuitable for the following reasons :—

(1) The production of fuel is the main object of management : small timber is of secondary importance as the demand is erratic and the present crop cannot meet a heavy demand for small timber.

(2) The species that are capable of producing small timber are not evenly distributed throughout the coupe.

(3) The system has been tried and found to be unsatisfactory.

The silvicultural system that best meets the objects of management and the silvicultural requirements of the crop throughout the working circle is simple coppice, and this system will be adopted.

340. *The rotation.*—(1) In the Sudikonda Sector it was thought that it might be necessary to raise the rotation from 30 years to 40 years to meet the demand for large fuel billets for the sugar factory at Samalkot, and small timber for local consumption, in addition to supplying fuel for ordinary domestic purposes. This matter was investigated, and it was found that :

(*a*) That there are no crops of known ages over 25 years old.

(*b*) That crops between 20 and 25 years of age were worked as coppice-with-standards ; and owing to over-lapping at past revisions of the working scheme no reliance can be placed on the recorded age of these crops.

(*c*) It was difficult to obtain a series of comparable plots in the coupes that are under 20 years old.

Consequently it was not possible to determine with accuracy the age at which the mean volume increment per acre culminates, and the average size of the trees in the crop at this age. It was found that by felling the unworked areas and the oldest coupes it would be possible to meet the demand for large billets, and small timber during the next ten years ; and we shall be in a better position to investigate the rotation at the end of this period. As the raising of the rotation cannot be definitely justified the present rotation of 30 years will be continued.

(2) In the Devancheruvu Sector it was thought that the correct financial rotation for the two felling series would probably be less than the present rotation of 25 years. The age of the oldest coupe in the two felling series is 22 years, and so a series of sample plots, fully stocked and reasonably comparable, were laid out and measured in coupes aged from 14 to 22 years as it was thought that the correct financial rotation would probably lie within this period. The results, which have already been referred to in Part I, Chapter VI, show that the current volume increment per acre is still rising at 22 years, and, as the mean volume increment culminates later than the current volume increment, there is no justification for the reduction of the rotation. It will continue to be 25 years.

341. *Regulation of the yield.*—The yield will be prescribed and regulated by area. An attempt has been made to lay out approximately equi-productive coupes in each felling series.

SECTION 6.—METHOD OF EXECUTING THE FELLINGS.

342. *Felling rules.*—The following felling rules will apply to both sectors :—

(1) The period of lease for all coupes will be one year : April 1st to March 31st. Extensions of the period of lease will be governed by the ordinary administrative rules.

(2) Each coupe will be divided into three approximately equal strips, and felling in each strip must be complete before work may commence in the next.

(3) All growth will be felled whether utilized or not, including trees that yield minor forest produce.

(4) All bamboo growing in the coupe is reserved and may not be felled by the coupe contractor.

(5) All trees will be felled as close to ground level as possible, and in no case more than 6″ above the ground ; but it is unnecessary to trim or shape the stools.

(6) In order to determine the yield of fuel with fair accuracy, six one-acre sample plots will be measured in each coupe during the course of the fellings ; two in each strip. The plots should be truly representative of the locality in which fellings are in progress when the plots are selected. The plots will be selected by the Range Officer, they will be felled and the produce will be stacked by the contractor's coolies, and the yield in stacked cubic feet will be measured and recorded by the Range officer. At the end of the year the mean yield of the six plots will represent the yield per acre for the coupe, and the area actually felled multiplied by the yield per acre will be the outturn for the coupe. All small timber obtained from the sample plot will be excluded from the yield of these plots.

(7) The yield of small timber cannot be estimated from sample plots as the crop is by no means homogeneous, the patches of small timber being confined to the better soils. The contractor will record details of the number of *Karras*, *Dulams*, *Bazus* and *Vasams* covered by each removal permit. The permits will be checked with the produce before removal, and the outturn for the year will be estimated from these permits.

SECTION 7.—TABULAR STATEMENT OF FELLINGS.

343. *Allotment of coupes.*—Coupes have been allotted only for the period of the working plan, but they have been marked on the working plan maps in correct sequence for the whole rotation ; and a separate statement shows the areas of the unallotted coupes :—

Tabular statement of fellings for the Sudikonda Sector.

Year.	Number of coupe.	Felling series.								Total area in acres to be felled each year.
		Sudikonda.		Tirumalayapalem North.		Tirumalayapalem South.		Mallavaram.		
		Area in acres.	Mean age at felling.	Area in acres.	Mean age at felling.	Area in acres.	Mean age at felling.	Area in acres.	Mean age at felling.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1934–35	I	60·5	Unfelled.	57·0	Unfelled.	45·5	28	45·0	35	208·0
1935–36	II	61·0	Do.	45·0	Do.	47·0	28	45·0	36	198·0
1936–37	III	73·0	Do. (part 19 years).	38·0	Do.	61·0	Unfelled.	67·0	37	239·0
1937–38	IV	51·5	20	47·0	Do.	34·5	Do.	50·5	Unfelled.	183·5
1938–39	V	57·0	20	87·0	Do. (part 23 years).	34·0	Do.	51·0	Do.	229·0
1939–40	VI	59·0	27	46·0	Do.	45·5	Do.	64·5	23	215·0
1940–41	VII	68·5	27	39·0	Do.	46·5	Do.	43·5	Unfelled.	197·5
1941–42	VIII	67·5	28	38·5	26	45·5	Do.	44·5	Do.	196·0
1942–43	IX	60·0	25	40·0	27	46·0	Do.	43·5	Do.	195·5
1942–43	X	66·0	26	52·0	Unfelled (part 28 years).	45·0	Do.	57·0	Do.	220·0

Tabular statement of fellings for the Devancheruvu Sector.

Year.	Number of coupe.	Felling series.				Total area in acres to be felled each year.	Remarks.
		Devancheruvu, West.		Devancheruvu, East.			
		Area in acres.	Mean age at felling.	Area in acres.	Mean age at felling.		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1934–35	I	43·5	21	31·5	33	75·0	These figures do not include the area occupied by the Great Northern Trunk road passing through the two felling series and all ground occupied by interior and exterior lines. These cover an area of 31 acres in the West felling series and 21·4 acres in the East felling series.
1935–36	II	51·5	22	30·5	33	82·0	
1936–37	II	52·5	23	32·5	33	85·0	
1937–38	IV	53·5	24	31·5	20	85·0	
1938–39	V	54·0	25	28·5	21	82·5	
1939–40	VI	54·5	25	30·5	22	85·0	
1940–41	VII	55·5	26	30·5	23	86·0	
1941–42	VIII	56·0	27	24·5	24	50·5	
1942–43	IX	57·0	28	23·0	25	80·0	
1943–44	X	51·0	28	24·5	26	75·5	

Tabular statement of unallotted coupes in the Upland Coppice Fuel Working Circle.

Name of sector.											
Sudikonda.								Devancheruvu.			
Felling Series.											
Sudikonda.		Tirumalayapalem, North.		Tirumalayapalem, South.		Mallavaram.		Devancheruvu, West.		Devancheruvu, East.	
Number of coupe.	Area in acres.	Number of coupe.	Area in acres.	Number of coupe.	Area in acres.	Number of coupe.	Area in acres.	Number of coupe.	Area in acres.	Number of coupe.	Area in acres.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
XI	68·0	XI	41·0	XI	43·5	XI	52·0	XI	52·0	XI	52·0
XII	47·0	XII	41·0	XII	43·0	XII	46·0	XII	52·0	XII	26·5
XIII	60·0	XIII	39·0	XIII	42·0	XIII	45·5	XIII	47·5	XIII	34·0
XIV	60·0	XIV	40·0	XIV	40·0	XIV	45·5	XIV	44·5	XIV	30·5
XV	59·0	XV	40·0	XV	36·0	XV	42·5	XV	48·5	XV	28·5
XVI	70·5	XVI	38·5	XVI	34·5	XVI	46·0	XVI	56·5	XVI	34·5
XVII	68·0	XVII	39·0	XVII	33·0	XVII	51·5	XVII	55·5	XVII	35·0
XVIII	68·5	XVIII	40·0	XVIII	36·0	XVIII	45·5	XVIII	52·5	XVIII	31·5
XIX	69·0	XIX	40·5	XIX	35·5	XIX	45·0	XIX	50·5	XIX	34·0
XX	69·0	XX	50·0	XX	36·0	XX	47·0	XX	43·5	XX	31·0
XXI	53·5	XXI	35·0	XXI	38·0	XXI	46·5	XXI	55·5	XXI	30·5
XXII	49·0	XXII	36·0	XXII	38·0	XXII	45·5	XXII	52·0	XXII	27·5
XXIII	45·0	XXIII	32·0	XXIII	38·0	XXIII	42·5	XXIII	56·5	XXIII	25·0
XXIV	38·0	XXIV	33·0	XXIV	35·5	XXIV	45·5	XXIV	45·5	XXIV	30·0
XXV	69·0	XXV	32·0	XXV	34·0	XXV	47·5	XXV	57·5	XXV	27·0
XXVI	61·0	XXVI	30·5	XXVI	36·0	XXVI	56·0	..	..	..	..
XXVII	64·0	XXVII	31·0	XXVII	36·0	XXVII	56·5	..	..	..	..
XXVIII	61·0	XXVIII	35·5	XXVIII	36·0	XXVIII	56·5	..	..	..	..
XXIX	62·0	XXIX	30·0	XXIX	37·5	XXIX	40·0	..	..	..	..
XXX	63·0	XXX	30·0	XXX	35·0	XXX	57·0	..	..	..	..

SECTION 8.—SUBSIDIARY SILVICULTURAL REGULATIONS.

344. *Rab sowings.*—Rab sowings will be confined to the coupes in the Sudikonda Sector.

A. General considerations.

The common method of improving the growing stock in fuel forests is to do rab sowings throughout the coupe, in strips or patches, after burning. This method is not suitable to the Sudikonda Sector for the following reasons :—

(1) Most of the coupes are well stocked with fuel, and rab sowings are necessary chiefly to increase the proportion of species that are capable of producing small timber as well as fuel. But the soil on the entire coupe is seldom suitable for growing these species ; and attempting to grow trees on unsuitable ground is a waste of time and money.

(2) In most of the blanks or understocked areas, the scarcity or absence of growth is invariably due to natural causes—chiefly to defective soil ; and there will be insufficient slash after felling to obtain the burn necessary for rab sowings.

(3) Even if the conditions throughout the coupes were favourable to rab sowings of the better species, it is doubtful that the sowings would succeed without suitable tending ; and as there is other cultural work to be done in these reserves the staff will not be able to devote sufficient attention to the tending of the rab sowings in the entire coupes of four felling series.

Considering these facts, and the special objects of the rab sowings, and accepting the principle that it is better to get good results on a small area than bad results on a large area, it has been decided to concentrate rab sowing on small areas in each coupe, and to make adequate arrangements for tending these areas.

B. Prescriptions for rab sowing.

The following rules will apply to all rab sowings in the Sudikonda Sector :—

(1) While fellings are in progress the Range Officer will select patches suitable for rab sowings in each of the four coupes in the Sudikonda Sector. The patches should be as large as possible consistent with suitability, and the aggregate area in each coupe should not exceed 10 acres.

(2) In April, immediately after felling the slash will be collected in lines 10 feet wide and 30 feet apart, running parallel to the width of the plot. The strips will then be burnt, and all coppice shoots damaged by the burn will be cut back.

(3) Immediately after cutting back the damaged coppice shoots along the burnt strips, the ash will be raked up with the soil to a depth of about 2 to 3 inches in patches 10 feet square and 10 feet apart, and the patches will be sown broadcast with the selected species. The area actually sown will be about one-eighth of the rab plot, and not more than an acre and a quarter. Patches in which the sowings made in April fail will be re-sown when the rains break.

(4) It must be remembered that all areas suitable for growing teak in the Sudikonda, Tirumalayapalem and Mallavaram reserves have been included in the Teak Conversion Working Circle, and so the patches selected for rab sowing will not be suitable for teak ; consequently they will be unsuitable for the common associates of teak. Therefore no attempt must be made to sow teak, rosewood, or *Pterocarpus marsupium*. The species that are most likely to succeed are : *Albizzia procera, Albizzia lebbek, Cleisthanthus collinus*, *Azadirachta indica* and *Polyalthia cerasoides*. The Provincial Silviculturist will be consulted periodically on the choice of species for rab sowings in these coupes.

C. Tending the rab sowings.

The rab sown patches will be tended as follows :—

(1) They will be weeded in August and again at the beginning of November. No attempt will be made to replace casualties when the patches are weeded as late sowings are not likely to succeed. The ground around patches of rab seedlings will be worked up along with the second weeding.

(2) In July, the year after sowing, all climbers will be eradicated, all soft woods will be cut back from 18 inches to 2 feet above ground, and the patches will be weeded if necessary.

345. *General tending.*—The following rules will apply to the whole working circle unless otherwise stated :—

(1) The year after felling climbers will be cut : the methods prescribed in paragraph 293, Chapter V being tried here also ; and soft woods such as *Cochlospermum gossypium, Erythrina suberosa* and *Dalbergia paniculata* will be cut back from 18 inches to 2 feet above ground.

(2) In the sixth year after felling there will be a second climber cutting, and the coppice will be cleaned by felling all dominant soft woods.

No other tending is necessary.

SECTION 9.—OTHER REGULATIONS.

346. *Demarcation.*—The coupes to be felled in April each year will be surveyed and demarcated before the 15th February. All coupe lines will be 10 feet wide and the strip lines will be 6 feet wide. Coupe stones of the standard pattern will be erected at all corners of the coupe the year after felling. The coupe lines will be maintained for ten years after felling corresponding to the period of closure to grazing. Thereafter it will be unnecessary to keep the lines clear.

347. *Fire protection.*—In addition to the maintenance of the permanent fire lines which will be referred to in Chapter XII, the outer boundary of all coupes or group of coupes that are under ten years old will be fire traced to a width of 30 feet.

348. *Grazing.*—Coupes will be closed to grazing for ten years including the year of felling. The coupes have been so arranged that the closure will cause no hardship or serious inconvenience.

SECTION 10.—CONTROL.

349. The following control records will be maintained:—

(1) The Control Book,
(2) The Record of Works,
(3) The Control Journal,
(4) The Control Map and
(5) The Record of Deviations.

Sample forms for the control book and the record of works will be found in Appendix VIII. The control map will be maintained on a scale of 4″ = 1 mile, a spare copy of the working plan map being used for the purpose. In addition to the usual details, it will show all areas regenerated by rab sowings in the Sudikonda Sector.

CHAPTER VIII.—WORKING PLAN FOR THE TEAK CONVERSION WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION OF THE CIRCLE AND CHARACTER OF THE VEGETATION.

350. *Objects of the working circle.*—The objects of the working circle are, to improve the value of the forests of Peddapur and Gokavaram ranges by planting teak wherever it can be grown successfully, and, while doing so, to find and establish markets for timbers such as *Lagerstrœmia parviflora*, *Albizzia lebbek* and *Terminalia tomentósa* which are fairly plentiful in parts of these ranges. There is no natural-grown teak in the Peddapur and Gokavaram ranges, but experimental planting during the past six years has shown that teak can be grown successfully on suitable soils ; and the rate of growth in the young teak plantations compares favourably with results obtained elsewhere in forests with a similar rainfall.

351. *General constitution of the working circle.*—The working circle includes all the lankas of Peddapur and Gokavaram ranges that are considered to be suitable for planting teak, and where there is sufficient saleable timber to cover the cost of conversion leaving a margin of profit. The lankas included in the working circle are distributed over ten reserves : five in Peddapur range, and five in Gokavaram range ; and the area suitable for teak in each reserve ranges from 43 acres in Virabhadrapuram reserve to 225 acres in Banadapalli reserve.

352. *Character of the vegetation.*—The growing stock has been described in paragraph 52 of this plan. It consists chiefly of mature miscellaneous timber. The quality of the crop declines from north to south ; the best lankas are in the Banadapalli reserve at the northern end of the working circle, while in the neighbourhood of Sudikonda, at the southern end of the working circle, the lankas deteriorate into superior fuel forests with comparatively little timber over 4 feet in girth.

SECTION 2.—PERMANENT DIVISION INTO BLOCKS AND COMPARTMENTS.

353. *Blocks.*—As the reserved forests included in the working circle are comparatively small, it is unnecessary to sub-divide them into separate forest blocks.

354. *Compartments.*—Each lanka will constitute a separate compartment. There will be one series of numbers for both ranges, starting in Banadapalli reserve and ending in Sudikonda reserve. The sequence of the compartment numbers runs more or less from north to south. The following statement shows the distribution and area of the compartments included in the working circle :—

Distribution and area of compartments in the Teak Conversion Working Circle.

Compartment number.	Forest reserve.	Area in acres.	Area included in each reserve.
(1)	(2)	(3)	(4)
			ACS.
1	Banadapalli	47·0	225.0
2	Do.	25·0	
3	Do.	14·0	
4	Do.	32·0	
5	Do.	42·0	
6	Do.	37·0	
7	Do.	28·0	
8	Rajavomangi	104·0	166·0
9	Do.	8·0	
10	Do.	18·0	
11	Do.	7·0	
12	Do.	6·0	
13	Do.	23·0	
14	Vatangi	17·0	207·0
15	Do.	19·0	
16	Do.	95·0	
17	Do.	56·0	
18	Do.	20·0	
19	Lododdi	41·0	
20	Do.	18·0	
	Area carried over	657·0	598·0
	Area brought forward	657·0	598·0
21	Lododdi	41·0	122·0
22	Do.	22·0	
23	Vuligogula	31·0	66·0
24	Do.	35.0	
25	Virabhadrapuram	19·0	43·0
26	Do.	24·0	
27	Lakkondah	83·0	83·0
28	Mallavaram	46.0	67·5
29	Do.	13·0	
30	Do.	8·5	
31	Tirumalayapalem	8·0	76·2
32	Do.	17·0	
33	Do.	19·0	
34	Do.	17·0	
35	Do.	7·6	
36	Do.	7·6	
37	Sudikonda	46·0	114·0
38	Do.	26·0	
39	Do.	35·0	
40	Do.	7·0	
	Area of working circle	1,169·7	1,169·7

NOTE.—Compartments 1 to 24 with an aggregate area of 786 acres are in Peddapur range and compartments 25 to 40, with an aggregate area of 383·7 acres, are in Gokavaram range.

SECTION 3.—SUBDIVISION OF THE WORKING CIRCLE.

355. *Felling series and reasons for their formation.*—The compartments included in the working circle are distributed over ten reserves; five of these reserves are located in the Peddapur range and the remaining five in the Gokavaram range. If there were only one felling series, work would be concentrated in the Peddapur range for part of the rotation, and in the Gokavaram range for the remaining part, whereas it is desirable to distribute the work over both ranges so that the areas planted each year will receive more attention. Besides, it would be advantageous to carry out conversion operations during the period of this plan in both forest sub-types: in the northern compartments where the soils and stands of timber are good but extraction is somewhat expensive, and in the southern compartments where the soils and crops are poorer but there is a demand for the produce and extraction is easy. It has therefore been decided to sub-divide the working circle into two felling series:—

> The Northern Felling Series, situated in Peddapur range, containing compartments 1 to 24, with a total area of 786 acres and the Southern Felling Series, situated in Gokavaram range, containing compartments 25 to 40, with a total area of 383·7 acres.

SECTION 4.—ANALYSIS AND VALUATION OF THE CROP.

356. *Analysis of the crop.*—The lankas that comprise the working circle were selected chiefly on the suitability of the soils for growing teak. Nearly all the selected areas are well-stocked, but the crops have not been analysed as it was unnecessary to do so. The lankas were surveyed and all the compartments that are to be converted during the period of this plan, as well as all compartments in Banadapalli, Sudikonda, Tirumalayapalem and Mallavaram reserves, have been marked on the working plan maps. These maps are enlargements to a four-inch scale, from the two-inch Survey of India map of Sudikonda-Tirumalayapalem and part of Mallavaram reserves, and from the one-inch Survey of India maps of part of Mallavaram and Banadapalli reserves. There was no necessity to prepare special maps for the remaining compartments, as the management maps of Peddapur and Gokavaram ranges show all areas included in the working circle.

357. *Valuation of the crop.*—No attempt has been made to value the crop.

SECTION 5.—METHOD OF TREATMENT.

358. *Treatment discussed and prescribed.*—The mixed deciduous forests of the lankas that constitute the working circle will be converted into teak plantations. The forests are mature or approaching maturity, and regeneration of the principal species is scarce. The re-establishment of these forests with natural reproduction would be slow and indefinite; and the artificial regeneration of *Lagerstrœmia parviflora* and *Terminalia tomentosa*, the principal species, would be difficult and uncertain. On the other hand the raising of teak plantations is comparatively easy, and experimental planting has shown that teak can be grown successfully on these lankas. In the Lower Godavari division, even third quality teak fetches better prices than any other local timber; and if, in the course of working, the demand for the local timbers increases and the price improves, there are other forests in the division which can meet the demand. Consequently, the selected areas that constitute the working circle will be utilized best by converting them into teak plantations.

359. *Silvicultural system.*—The silvicultural system will be clear-felling. The entire crop will be removed, and the coupe will be regenerated with one-year-old teak stumps planted at an espacement of 6 feet by 6 feet.

360. *Rotation.*—The natural conditions are similar to those that prevail in the Timber Clear-felling Working Circle, and so the rate of growth of teak will probably be the same. The plantations are expected to attain maturity at a mean girth of between 3 and 4 feet, which corresponds to an age of about 50 years according to the rate of growth in the Timber Clear-felling Working Circle. Therefore the rotation will be 50 years.

361. *The period of conversion.*—The period of conversion is influenced by two considerations:—

(1) The area worked each year should not be larger than can be planted and tended satisfactorily.

(2) The material obtained from the fellings should not be more than can be sold during the year.

At present there is not much demand for the timber obtained from these lankas, and the area that can be satisfactorily planted each year and properly tended thereafter is reckoned to be about 20 acres. In order to obtain a complete series of plantations, in the period of conversion, the average area to be felled and planted each year would be about 23½ acres. As there are two felling series, and the work will be distributed over two ranges, there ought to be no difficulty in working this area and disposing of the timber and other produce obtained from the fellings. Therefore the period of conversion will be 50 years. As the timber compartments which constitute the working circle are scattered wide apart, and as it is undesirable to combine small isolated areas to form a coupe, each compartment has been divided into two or more complete coupes. The areas of the compartments differ widely : consequently there is a small difference in the areas of the coupes.

362. *Regulation of the yield.*—The yield will be prescribed and regulated by area.

SECTION 6.—THE FELLINGS.

363. *Felling agency.*—In the Southern Felling Series, the coupes to be worked during the period of the plan are situated in the neighbourhood of Sudikonda and are easily accessible. These will be sold standing to contractors. The coupes of the Northern Felling Series are located in Banadapalli reserve at the extreme end of the Peddapur range. On account of the long lead to the nearest market only part of the crop can be extracted at a profit ; and, until the working of these remote areas is well-established, it will probably not be possible to sell the coupes to contractors. These will be worked departmentally, until contractors can be found to buy the standing coupes.

364. *Felling rules.*—As the existing crops are to be replaced by teak plantations the only felling rules are :—

(1) Fellings will commence in the beginning of December 1st and will be completed by the end of February.

(2) The entire crop will be clear-felled including all bamboo, and species that yield minor forest produce.

(3) The trees and bamboo clumps are to be felled as low as possible : not more than 1 foot above ground.

365. *Tabular statement of fellings.*—Coupes have been allotted, and fellings prescribed only for the period of the working plan.

Tabular statement of fellings for the Teak Conversion Working Circle.

Year of felling.	Southern Felling Series.			Northern Felling Series.			Total area to be felled.
	Coupe number.	Compartment number.	Area of coupe in acres.	Coupe number.	Compartment number.	Area of coupe in acres.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1934–35	I	38	13·0	I	4	11·0	24·0
1935–36	II	37	11·0	II	5	10·0	21·0
1936–37	III	31	8·0	III	2	12·5	20·5
1937–38	IV	38	13·0	IV	4	10·0	23·0
1938–39	V	37	12·0	V	5	10·0	22·0
1939–40	VI	35	7·6	VI	2	12·5	20·1
1940–41	VII	36	7·6	VII	3	14·0	21·6
1941–42	VIII	37	12·0	VIII	5	11·0	23·0
1942–43	IX	33	10·0	IX	4	11·0	21·0
1943–44	X	37	11·0	X	5	11·0	22·0
		Total ..	**105·2**			**113·0**	**218·2**

SECTION 7.—SUBSIDIARY SILVICULTURAL OPERATIONS.

A. Planting.

366. *Nursery work.*—Nurseries will be established at convenient places to be chosen by the District Forest Officer. Teak seed will be obtained from the Polavaram range, and the nursery work will be conducted on the same lines as in the Timber Clear-felling Working Circle, the same precautions being taken to start nursery work early, so that germination will be complete and the nursery beds fully stocked when the rains break. On an average 30,000 stumps will be wanted each year for planting and replacement of casualties : 14,500 for the Southern felling series, and 15,500 for the Northern felling series.

367. *Preparation of the ground.*—The coupe to be planted during the year will be burnt in the first week of April, the slash being raked up and distributed to get a good even burn, throughout the coupe. If the first burn has not been completely successful, all unburnt slash will be piled and re-burnt a fortnight later. In the middle of May the coupe will be staked out for planting at an espacement of 6′ × 6′.

368. *Planting.*—Planting will commence at the end of May or early in June according to the weather. One year old teak stumps with 9-inch roots and 1-inch stems will be planted in crow-bar holes at the planting stakes. All damaged stumps will be rejected. Particular care will be taken that, when the stumps are planted, the tips of the roots are firmly gripped by the soil as explained in Chapter V, paragraph 287. The planting must be properly organized, carefully supervised, and completed as soon as possible. It should not take more than a week to plant up each coupe.

369. *Replacement of casualties.*—All failures at the stakes will be replanted when the rains break and subsequent casualties will be replaced along with the first weeding. Thereafter there will be no replacement of casualties unless large areas fail.

B. Tending the plantations.

370. *First weeding.*—The time for the first weeding will depend on the weather and the weed growth. In ordinary years it will probably be necessary about the end of August. As the plantations are small, weeding will be closely supervised, and will be carried out in the following manner : In one half of the first coupe, strips 4 feet wide—2 feet on each side of the planting lines—will be clean-weeded ; the weeds on the intervening 2 feet strips will be cut and the weeds from the 4 feet strips will be piled on the cut weeds. In the other half of the coupe strips 2 feet wide on each side of the planted rows will be scraped clean with mamutis, the weeds being piled on the burnt strips. A careful record of costs will be maintained for each operation. Thereafter the method adopted will be left to the discretion of the District Forest Officer who will keep in touch with developments in weeding practice by correspondence with the Provincial Silviculturist. Climber cutting will be carried out along with the first weeding.

371. *Second weeding and aeration of soil.*—The second weeding will be done when necessary, but not later than the end of December of the same year. The most suitable time will probably be the end of the north-east monsoon : about the middle of December. The work in each half of the coupe will be the same as in the first weeding, except that in the planting rows treated under the first method the soil will be worked up for a radius of 2 feet around the teak plants. A careful record of costs will be maintained for each operation. After the first year the method adopted will be left to the discretion of the District Forest Officer.

372. *Nipping off the heads of superfluous shoots.*—If any teak stumps throw out more than one shoot the heads of the smaller shoots will be broken off by hand along with the second weeding. But if there are two shoots of equally good shape and size both will be retained until the plantation is pruned.

373. *Third weeding, climber cutting and cleaning.*—Further weeding will be carried out at the discretion of the District Forest Officer. Provided none has been found necessary earlier, the third weeding will not be postponed beyond August 30th of the second year, and it will be accompanied by climber cutting and cleaning. No definite prescriptions can be laid down for the third weeding, for the height of the plants and the extent of weeding that is necessary will vary greatly. The weeding will be done under the direction of the District Forest Officer. In cleaning the plantation, all soft wood coppice shoots will be felled from 18 inches to 2 feet above ground, and other tree growth will be coppiced. Thereafter, all tree growth that persists under the shade of the teak will be retained as an under wood.

The Provincial Silviculturist should be consulted on the question of weedings periodically, as little is known about the requirements of these dry forests in this respect, and a revision of the above prescriptions may well become advisable in the course of a year or two.

374. *Pruning.*—The plantation will be pruned along with the third weeding. The purpose of the pruning is to remove all subsidiary shoots that are competing with the main stem leaving only one shoot to develop into a straight well grown sapling. If the plants are forked and there are two stems, more or less equal in vigour and shape, a choice must be made between the two : one will be retained and the other removed. Pruning must be done flush with the main stem without tearing or lacerating the bark, and a sharp pruning knife must be used for the purpose. This operation needs efficient direction and careful supervision.

375. *Subsidiary tending.*—After the second year the young plantations should be beyond injury from weeds, but climber cutting may be necessary in the third or fourth year. The plantations will be inspected by the District Forest Officer at this stage to ensure that they are free of climbers.

376. *Thinning.*—Teak, being a fast growing light demanding species, is intolerant of crowding, and needs plenty of light and growing space, which must be provided throughout the period of growth by means of frequent and judicious thinning. The purpose of thinning is to promote the growth of the progressive dominant stems, amongst which are the trees that will form the final crop. In all teak plantations a few trees will lag behind but nothing can be done for these backward, suppressed stems. Thinning is most beneficial when the growth is most rapid ; and, since teak grows most rapidly during the first twenty to thirty years, thinning should be most frequent during this period. In practice the frequency of thinning is often restricted by the extent of the area to be thinned each year, but, as the plantations of this working circle will be small, thinning will be regulated solely by the silvicultural requirements of the crop. It is desirable to commence thinning just before the crowns meet, and repeat it when the gaps are about to close up. When in doubt, it should be remembered that the struggle for existence between individual stems retards the growth of the crop, so it is better to thin early than late. The experimental plantations in Tirumalayapalem and Rajavomangi reserves indicate that the first thinning will be necessary when the plantations are from 5 to 7 years old, according to the quality of the crop ; but there is nothing to show when the second or subsequent thinnings will be needed. In order to ensure that thinning will not be neglected it is prescribed that the plantations will be inspected for thinning by the District Forest Officer when they are five years old, and annually thereafter until they are thinned. The plantations will be inspected again for thinning five years after the first thinning, and annually thereafter until the second thinning is carried out. The reasons for postponing the thinning after each inspection will be recorded in the remarks column of the ' Record of Works '. It would be premature to prescribe for subsequent thinnings in this working plan.

377. *Tending the intermediate compartments.*—It is not necessary to undertake selection or improvement fellings in these compartments at the present stage. This matter will be investigated at the next revision of the working plan. Climber cutting on a 5-year cycle will be carried out in the compartments that will not be taken up for conversion during the period of this plan.

SECTION 8.—OTHER REGULATIONS.

378. *Demarcation.*—The coupes to be felled in December will be demarcated before the end of October each year ; and the compartments to be taken up for climber cutting in September will be demarcated before the end of June.

379. *Fire protection.*—In addition to the maintenance of the permanent fire lines which will be referred to in Chapter XII, the outer boundary of all coupes or groups of coupes that are planted under this working plan will be fire traced to a width of 50 feet.

380. *Protection against grazing.*—All coupes that are planted with teak under this plan will be permanently closed to grazing. This will cause no hardship or inconvenience.

381. *Tabular statements.*—The following statements show the work to be done each year and the operations which ordinarily will be carried out each month. The monthly calendar of operations is intended as a general guide and not as a definite prescription.

ANNUAL CALENDAR OF WORKS FOR THE TEAK CONVERSION WORKING CIRCLE.

Year.	Areas to be demarcated.			Areas to be felled.		Areas to be regenerated.		Areas for third weeding, climber-cutting, clearing and pruning.		Areas to be inspected for first thinning.		Intermediate compartments for climber-cutting.		Remarks.
	Coupe to be felled.	Compartments for climber-cutting.	Total length of boundaries.	Coupe number.	Area in acres.	Coupe number.	Area in acres.	Coupe number.	Area in acres.	Coupe number.	Area in acres.	Numbers.	Total area in acres.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
			M. F. CH.											
						A. Northern Felling Series.								
1934-35 ..	I	1, 6 to 13 ..	11 6 3	I	11·0	..	..	..	..	..	..	1, 6, 7 and 13 ..	135·0	(1) For the purpose of this statement, the term 'regenerated' includes burning, staking, stumping two weedings during the first year, replacement of casualties and aeration of the soil.
1935-36 ..	II	14 to 16	3 4 5	II	10·0	I	11·0	..	..	..	..	8 to 12	143·0	
1936-37 ..	III	17, 18, 23 and 24.	4 4 9	III	12·5	II	10·0	I	11·0	..	..	14 to 16	131·0	
1937-38 ..	IV	19 and 20 to 22.	4 5 5	IV	10·0	III	12·5	II	10·0	..	..	17, 18, 23 and 24.	142·0	
1938-39 ..	V	Nil	0 6 2	V	10·0	IV	10·0	III	12·5	..	..	19 to 22 ..	122·0	
1939-40 ..	VI	Nil	0 5 1	VI	12·5	V	10·0	IV	10·0	..	..	1, 6, 7 and 13 ..	135·0	
1940-41 ..	VII	Nil	0 3 7	VII	14·0	VI	12·5	V	10·0	I	11·0	8 to 12	143·0	
1941-42 ..	VIII	Nil	0 2 7	VIII	11·0	VII	14·0	VI	12·5	II	10·0	14 to 16	131·0	
1942-43 ..	IX	Nil	0 3 4	IX	11·0	VIII	11·0	VII	14·0	III	12·5	17, 18, 23 and 24.	142·0	
1943-44 ..	X	Nil	..	X	11·0	IX	11·0	VIII	11·0	IV	10·0	19 to 22	122·0	
1944-45 ..	..	.. .. ..	..	..	..	X	11·0	IX	11·0	V	10·0	....	..	
						B. Southern Felling Series.								
1934-35 ..	II	33 (part), 39, 40, 29, 30, 32 and 34.	3 7 6	I	13·0	..	..	..	..	..	..	33 (part), 39 and 40.	51·0	(2) The areas to be inspected for the second thinning will depend on the date of first thinning.
1935-36 ..	III	28	2 4 9	II	11·0	I	13·0	..	..	..	..	29, 30, 32 and 34.	55·5	
1936-37 ..	IV	27	2 3 5	III	8·0	II	11·0	I	13·0	..	..	28	46·0	
1937-38 ..	V	25 and 26 ..	1 6 8	IV	13·0	III	8·0	II	11·0	..	..	27	83·0	
1938-39 ..	VI	Nil	0 4 7	V	12·0	IV	13·0	III	8·0	..	..	25 and 26 ..	43·0	
1939-40 ..	VII	Nil	0 3 9	VI	7·6	V	12·0	IV	13·0	..	..	33 (part), 39 and 40.	51·0	
1940-41 ..	VIII	Nil	0 2 1	VII	7·6	VI	7·6	V	12·0	I	13·0	29, 30, 32 and 34.	55·5	
1941-42 ..	IX	Nil	0 4 0	VIII	12·0	VII	7·6	VI	7·6	II	11·0	28	46·0	
1942-43 ..	X	Nil	0 1 7	IX	10·0	VIII	12·0	VII	7·6	III	8·0	27	83·0	
943-44 ..	XI	Nil	..	X	11·0	IX	10·0	VIII	12·0	IV	13·0	25 and 26 ..	43·0	
944-45 ..	..	.. .. ..	..	..	..	X	11·0	IX	10·0	V	12·0	..	..	

Monthly Calendar of operations for the Teak Conversion Working Circle.

April	(1) The coupe to be regenerated during the year will be burnt. (2) Nurseries will be prepared.
May	(1) The coupe to be regenerated during the year will be staked. (2) Teak seed will be sown in the nurseries at the beginning of the month. (3) The coupe to be regenerated during the year will be planted with stumps if the season is favourable.
June	(1) The coupe to be regenerated during the year will be planted at the beginning of the month if not done at the end of May. (2) Replacing failures at the stakes when the rains break.
July	(1) Demarcation of coupes and compartments to be worked during the year. (2) Replacement of failures at the stakes if not done in June.
August	(1) First weeding and replacement of casualties in the coupe planted during the year. (2) Third weeding, climber-cutting, cleaning and pruning in the coupe planted during the previous year.
September	Climber cutting in the intermediate compartments.
October and November.	No special work as these months are particularly malarial.
December	(1) Second weeding, aeration of soil, and nipping off heads of superfluous shoots in the coupe planted during the year. (2) Thinning. (3) Fellings commence.
January	(1) Fire protection commences. (2) Fellings in progress.
February	(1) Fire protection will be completed by the 15th of the month. (2) Fellings will be completed by the end of the month.
March	No special works. Make sure that sufficient good seed is available for sowing in the nurseries in May.

NOTE.—(i) Nursery work will be in progress throughout the year.

(ii) The prescriptions of paragraphs 376, 377 and 379 will be applied to all the experimental Teak Plantations in Peddapur and Gokavaram Ranges ; and the inclusion of these plantations in the Teak Conversion Working Circle will be considered at the first revision of the working plan.

SECTION 9.—CONTROL.

382. *Control records.*—The following control records will be maintained :—

(1) The Control Book,
(2) the Record of Works,
(3) the Control Journal,
(4) the Control Map and
(5) the Record of Deviations.

Sample forms of the control book and the record of works will be found in Appendix VIII. The control map will be maintained on spare copies of the four-inch working plan maps.

CHAPTER IX.—WORKING PLAN FOR THE BAMBOO WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION OF THE WORKING CIRCLE AND CHARACTER OF THE VEGETATION.

383. *General constitution of the working circle.*—The working circle comprises all the reserved forests of the division that contain bamboo in sufficient quantity for remunerative working. It includes the following reserves :—

(*a*) Papikonda reserve east of the Papikonda ridge, Kopalli reserve, and Kovvada blocks I and II of Polavaram range ;
(*b*) all the reserved forests of Gokavaram range ; and
(*c*) all the reserved forests of Peddapur range except the Anantaram reserve.

There is very little bamboo in the western extremity of Papikonda reserve and in the Beddadanole and Marlagudem reserves of Polavaram range, so these forests have not been included in the working circle. The Anantaram reserve of Peddapur range has been excluded from the working circle because bamboo flowered extensively in this reserve in 1931, and it will be unfit for working throughout the period of this plan. There are no bamboo forests in the Rajahmundry range.

384. *Position in relation to other working circles.*—The Bamboo Working Circle overlaps the Puliramudugudem felling series of the Timber Clear-felling Working Circle, the Papikonda Experimental Working Circle, the Sudikonda Sector of the Upland Coppice Working Circle, the Teak Conversion Working Circle, and parts of the Minor Produce and Grazing Working Circles. The extraction of bamboo will not impede the work in the other circles; but all areas that are regenerated, under the prescriptions of this plan, in the Timber Clear-felling Working Circle, the Papikonda Experimental Working Circle, and the Teak Conversion Working Circle, will be closed to bamboo fellings during the period of this plan. At present these forests contain very little bamboo, and as they will be denuded of all bamboo at the time of regeneration, and the areas are small, the closure will not affect the yield from the bamboo coupes to any appreciable extent, therefore it is unnecessary to readjust the areas of the coupes during the period of this plan.

385. *Character of the vegetation.*—The bamboo forests of the Lower Godavari division have been described in Part I, Chapter II. Bamboo occurs in strips and patches of varying size and density in all the reserves included in the working circle; and in all such forests there are large patches containing no bamboo. The distribution appears to be regulated chiefly by soil and configuration; while the density and quality of the bamboo forests are influenced by the amount of over-head cover and the intensity of working. In common with most bamboo forests, the accessible areas are over-worked and the crop is degraded, while the more remote areas are very lightly worked and there are large patches of virgin bamboo. *Dendrocalamus strictus* is the principal species, forming about 85 per cent of the area under bamboo, the remaining 15 per cent being *Bambusa arundinacea*. There is very little *Bambusa* in the Polavaram and Peddapur ranges, the only large patches being at the southern extremity of Kovvada Block I in Polavaram range, and along the western boundary of Lingamparti reserve, and at the southern extremity of Vuligogula reserve, in the Peddapur range. In the Gokavaram range *Bambusa* is more plentiful than *Dendrocalamus*: it covers an area of over 11,000 acres forming about 60 per cent of the total area under bamboo. It is found chiefly in the Tirumalayapalem, Sudikonda, Mallavaram and Molleru reserves in the southern half of the range. *Dendrocalamus strictus* flowered gregariously in the Peddapur and Gokavaram ranges in 1918; but nothing definite is known about the last general flowering of this species in Polavaram range, and of *Bambusa arundinacea*. At present there is sporadic flowering throughout the division; and it is believed that there will be a general flowering in parts of the division in a few years time: probably within the period of this working plan.

386. *Area and distribution.*—The total area included in the Bamboo Working Circle is 190,180 acres, distributed over three ranges as shown in the following statement:—

Range.	Area included in the Bamboo Working Circle.			
	Under Dendrocalamus (approximate).	Under Bambusa (approximate).	Containing no bamboo (approximate).	Total area.
(1)	(2)	(3)	(4)	(5)
	ACS.	ACS.	ACS.	ACS.
Polavaram	31,453	645	7,570	39,668
Gokavaram	8,592	11,259	34,285	54,136
Peddapur	36,106	1,791	58,479	96,376
Total ..	76,151	13,695	100,334	190,180

SECTION 2.—ANALYSIS OF THE GROWING STOCK.

387. *Stock-mapping.*—All the reserved forests included in the working circle have been stock-mapped to show where the bamboo in each reserve is located, and the density of the stocking. The stock-maps of Peddapur and Gokavaram ranges show the distribution of bamboo in three densities:—

(1) Sparse—under 30 clumps per acre, averaging from 10 to 12 clumps.

(2) Medium—30 to 70 clumps per acre, averaging about 50 clumps.

(3) Dense—over 70 clumps, averaging about 100 clumps.

The stock-maps of Polavaram range show only the distribution of bamboo: it was considered unnecessary to stock-map these forests in greater detail, and the quantity of bamboo in each reserve has been estimated from notes on densities made in the field. Survey of India 4-inch maps were used in the field for the preparation of the bamboo stock-maps of Polavaram range, and old Madras Survey 4-inch maps were the only maps available for the preparation of the stock-maps of Peddapur and Gokavaram ranges. The former are accurate: whereas the old Madras Survey Maps are generally inaccurate; and, as the topographical details have been roughly sketched in on these maps, it was difficult to stock-map with accuracy. Later, when 1-inch Survey of India topographical maps were available, the stock-maps were corrected in the field with these maps, and finally reduced to a scale of 1-inch to a mile, consolidated stock-maps on this scale being prepared for all three ranges. To facilitate inspection and control, the stock-mapping details have been posted on the working plan maps for the Bamboo Working Circle. The areas given in the previous paragraph have been computed from these maps. It is not claimed that these areas are precisely accurate, but they are accurate enough for the purposes of this working plan.

388. *Estimate of the growing stock for the purpose of subdivision.*—In order to estimate the quantity of bamboo in each reserve for the purpose of laying out approximately equi-productive coupes, it was found necessary to reduce the stock-mapping details to bamboo units. For this purpose a bamboo unit is equivalent to 10 acres of bamboo of medium density, averaging 50 clumps per acre, or approximately 500 clumps; and, in order to convert areas stocked with sparse or dense bamboo into bamboo units, one acre of medium density is equivalent to half an acre of dense bamboo, and 4 acres of sparse bamboo. The stock of bamboo in each reserve has been estimated in units on this basis, in order to facilitate subdivision into approximately equi-productive coupes.

SECTION 3.—SUBDIVISION OF THE WORKING CIRCLE.

389. *General remarks.*—In the Bamboo Working Circle the order of subdivision has been inverted; the coupes have been delimited first, and then grouped into felling series, necessary adjustments being made in the areas of the coupes so that the total number of coupes would be a multiple of the period fixed as the felling cycle.

390. *The felling cycle.*—The felling cycle is limited by two extremes: the age at which a culm is exploitable, and the age at which it dies. Ordinarily culms are not exploited until they are one year old; but nothing definitely is known of the average age at which culms wither and die—on insufficient data this has been estimated at 4 to 7 years. Economically, the most suitable felling cycle is the lowest cycle on which bamboo can be worked without deterioration of the culms. In accordance with modern practice the felling cycle has been fixed at three years.

391. *Subdivision into coupes.*—In subdividing the Bamboo Working Circle into coupes each range has been treated separately so that no felling series overlaps the boundaries of a range. An attempt has been made to divide the working circle into more or less equi-productive coupes, the average quantity of bamboo in each coupe being between 200 and 300 units; but in practice it was found necessary to sacrifice equality of yield in order to obtain well-marked natural boundaries so that it would not be necessary to cut lines to demarcate the bamboo coupes. The subdivision represents an adjustment between these two considerations.

392. *Formation of felling series.*—The coupes have been grouped into sixteen felling series: five in Polavaram range, four in Gokavaram range, and seven in Peddapur range. Details for each felling series are furnished in the following statement:—

SUBDIVISION OF THE BAMBOO WORKING CIRCLE INTO FELLING SERIES.

Felling series—Number and name.	Reserves included in the felling series.	Area in acres.			
		Dendrocalamus (approximate).	Bambusa (approximate).	Without bamboo (approximate).	Total.
(1)	(2)	(3)	(4)	(5)	(6)
	I. Polavaram Range.				
1 Ravigudem ..	Papikonda reserve, east of the Papikonda terrace, and north of the Pata Vagu till it meets the main road, thence east of the road and north of the Gampa Vagu.	4,721	Nil.	541	5,262
2 Kotrupalli	The remainder of Papikonda reserve, east of the Papikonda terrace, and the whole of Kovvada block II.	4,372	3	1,137	5,512
3 Munjulur	The north-east corner of Kopalli reserve, east and north of the Papikonda Salu and the Marajalli Kalava and Kovvada block I, north of the foot-path from Kopalli to Virannapalem and Gummaluru and the path from Gummaluru to Dondapudi.	9,086	34	585	9,705
4 Puliramudugudem.	The whole of Kopalli reserve except the portion included in the Munjulur felling series.	7,195	42	3,538	10,775
5 Kovvada	The whole of Kovvada block I, south of the foot-path from Kopalli to Virannapallam and Gummaluru, and the foot-path from Gummaluru to Dondapudi.	6,079	566	1,769	8,414

Felling series—Number and name.	Reserves included in the felling series.	Area in acres.			
		Dendrocalamus (approximate).	Bambusa (approximate).	Without bamboo (approximate).	Total.
(1)	(2)	(3)	(4)	(5)	(6)
	II. Gokavaram Range.				
6 Mallavaram ..	The whole of Mallavaram and Tirumalayapalem reserves.	32	3,989	8,574	12,595
7 Lakkonda	The whole of Lakkonda and Sudikonda reserves.	2,969	1,514	12,507	16,990
8 Molleru	The whole of Molleru reserve	1,029	3,078	4,604	8,711
9 Virabhadrapuram.	The whole of Virabhadrapuram and Doramamidi reserves.	4,562	2,678	8,600	15,840
	III. Peddapur Range.				
10 Labberti	The whole of Labberti, Anantagiri, Singampalli and Ultimathula reserves.	6,394	18	8,461	14,873
11 Banadapalli ..	The whole of Banadapalli and Lododdi reserves.	5,192	Nil.	7,860	13,052
12 Aminbada	The whole of Aminbada and Rajavommangi reserves.	4,279	18	8,716	13,013
13 Vatangi	The whole of Vatangi reserve	4,764	Nil.	3,870	8,634
14 Lingamparti ..	The whole of Peddagarangi, Lingamparti, Raghavapatnam and Sarlanka reserves.	4,577	958	17,165	22,700
15 Jaddangi	The whole of Jaddangi and Vuligogula reserves.	4,778	447	10,572	15,797
16 Annavaram ..	The whole of Annavaram reserve ..	6,122	350	1,835	8,307
	Total area ..	**76,151**	**13,695**	**100,334**	**190,180**

393. *Location of the bamboo coupes.*—As the working plan maps for the Bamboo Working Circle are on a small scale—1 inch to a mile, it will probably be difficult to locate the coupes from the maps alone. Therefore it was considered necessary to describe the location of each coupe briefly, and the boundaries in detail. The following statement will prove helpful in locating the coupes on the ground and in preparing the annual sale notifications :—

SUBDIVISION OF THE FELLING SERIES INTO COUPES.

Coupe number.	Area in acres.	Location and boundaries.	Main extraction routes.
(1)	(2)	(3)	(4)
		I. THE RAVIGUDEM FELLING SERIES.	
I	2,196	Papikonda reserve, west and north of the Ravigudem enclosure— *Boundaries.*—*North*—Starting from the point where the Papikonda Salu meets the northern boundary of the reserve, eastwards along the boundary as far as the timber skidway ; *East*—Along the timber skidway and the main road to the Pata Vagu ; *South*—The Pata Vagu as far as the Papikonda Salu ; *West*—The Papikonda Salu to the starting point.	1 Until the skidway is constructed, the Ravigudem-Koruturu drag path. 2 Thereafter, the main road and the skidway.
II	1,438	A narrow strip of Papikonda reserve, east of the main road and north of the Gampa Vagu— *Boundaries.*—*North*—From the north-east corner of coupe I, along the reserve boundary line as far as the Patagondi Kalva ; *East*—Southwards along the Patagondi Kalva to clinometric height 1,560 on the boundary line of the reserve, thence along the boundary of the reserve to the Gampa Vagu ; *South*—The Gampa Vagu as far as the Chilekalur enclosure line ; *West*—The Chilekalur enclosure and the main road as far as the Pata Vagu ; thence the eastern boundary of coupe I.	1 Until the skidway is constructed, the Ravigudem-Koruturu drag path. 2 Thereafter the main road and the skidway. 3 The Sivagiri drag path.
III	1,628	The north-east extremity of Papikonda reserve— *Boundaries.*—*North*—Starting from the north-east corner of coupe II along the reserve boundary ; *East*—The reserve boundary ; *South*—The reserve boundary as far as clinometric height 1,560 ; *West*—Northwards along the eastern boundary of coupe II to the starting point.	Rough drag paths to Sivagiri and Chidur.

Coupe number.	Area in acres.	Location and boundaries.	Main extraction routes.
(1)	(2)	(3)	(4)
		II. KOTRUPALLI FELLING SERIES.	
I	2,076	A portion of Papikonda reserve between the Pata Vagu and the Gampa Vagu— *Boundaries.*—*North*—Starting from the south-west corner of coupe I of the Ravigudem series, eastwards along the Pata Vagu to the main road; *East*—The main road to the Chilekalur enclosure; *South*—Westwards along the northern boundary line of the Chilekalur enclosure, the Gampa Vagu, and the northern boundary of the Daravada enclosure to the north-west corner of the enclosure, thence southwards along the western boundary of the Daravada enclosure to the northern extremity of the Kotrupalli enclosure, thence along the western boundary of the Kotrupalli enclosure to the boundary line, thence westwards along the reserve boundary line to the Papikonda Salu; *West*—The Papikonda Salu to the starting point.	1 Until the skidway is constructed, the Daravada-Ravigudem-Koruturu drag path. 2 Thereafter the main road and the skidway.
II	1,230	The whole of Papikonda reserve lying south of the Gampa Vagu and east of the Papikonda Salu, and the north-east corner of Kovvada block II— *Boundaries.*—*North*—Starting from the south-west corner of the Daravada enclosure, along the southern boundary of this enclosure up to the Gampa Vagu, thence the Gampa Vagu until it meets the Chilekalur enclosure line, thence along the western, southern and eastern boundaries of the Chilekalur enclosure up to the Gampa Vagu, thence along the Gampa Vagu until it meets the boundary of Papikonda reserve; *East*—Southwards along the boundary of Papikonda reserve and Kovvada block II as far as the Sengal Kalava; *South*—The Sengal Kalava as far as the south-east corner of the Kotrupalli enclosure, thence along the southern boundary of this enclosure until it meets the reserve boundary line; *West*—Northwards along the western boundary of the Kotrupalli enclosure to the starting point.	1 The Kotrupalli-Koruturu drag path until the main road and skidway are constructed and thereafter the main road and the skidway. 2 The Ginnepalli-Chintapalli-Puliramudugudem cart-track.
III	2,206	The whole of Kovvada block II, south of the Kotrupalli enclosure and the Sengal Kalva— *Boundaries.*—*North*—Starting from the south-west corner of the Kotrupalli enclosure, eastwards along the southern boundary of this enclosure as far as the Sengal Kalava; *East*, *South* and *West*—The boundary of Kovvada block II to the starting point.	The extraction routes are the same as for coupe II.
		III. THE MUNJULUR FELLING SERIES.	
I	2,954	Portions of Kopalli reserve and Kovvada block I on each side of the Puliramudugudem-Chintapalli foot-path— *Boundaries.*—*North*—Starting from clinometric height 893 where the Chirika Vagu cuts the boundary of Kopalli reserve, eastwards along the northern boundary line of Kopalli reserve and Kovvada block II to clinometric height 933 where the Nugumamidi Vagu cuts the boundary line; *East*—From clinometric height 933, southwards along the Nugumamidi Vagu for 50 chains, thence at a bearing of 117° and a distance of 26 chains, to a conical hill, thence at a bearing of 55° and a distance of 20 chains to a saddle south-west of Gummuluru Konda, thence south-south-west along a stream for about 750 yards until it meets a foot-path to Kopalli, thence along this path to the reserve boundary; *South*—Westwards along the boundary line of Kovvada block I and Kopalli reserves, across the Pedda Kalava to a point 30 chains beyond the reserve; *West*—From the last named point, past clinometric height 894 to Nakkiru Konda 1,510, and thence *via* Maddi Konda 1,580 to the starting point.	1 The Munjulur-Puliramudugudem-Kannapuram cart-track. 2 The Virannapalem-Kopalli-Kannapuram cart-track.
II	3,205	The north-east corner of Kopalli reserve— *Boundaries.*—*North*—Starting from clinometric height 1,527 at the north-east extremity of Kopalli reserve, southwards along the reserve boundary line to the north-west corner of coupe I; *East*—Thence along the western boundary of coupe I to the starting point; *South*—Thence in a north-westerly direction along the reserve boundary line to the point where the Marajalli Kalava cuts the reserve boundary, and thence along the Marajalli Kalava to the main ridge; *West*—Thence northwards along the Papikonda Salu past points 2,070, 2,030, 2,070 and 2,070 to the starting point.	The Munjulur-Puliramudugudem-Kannapuram cart-track.

Coupe number. (1)	Area in acres. (2)	Location and boundaries. (3)	Main extraction routes. (4)
		III. THE MUNJULUR FELLING SERIES—*cont.*	
III	3,906	The northern end of Kovvada block I adjacent to the Gummuluru enclosure— *Boundaries.*—*North*—Starting from clinometric height 933 at the north-east corner of coupe I, the northern boundary of Kovvada block I as far as the Pedda Vagu; *East*—Thence southwards along the eastern boundary of Kovvada block I until it meets the Gummuluru foot-path at point 730; *South*—Thence along the foot-path to Gummuluru enclosure, then south and west along the enclosure line until it meets the Gummuluru-Virannapalem path, thence along this path to the Virannapalem enclosure, thence west and south along the enclosure line until it meets the Virannapalem-Kopalli path, thence along this path to the south-east corner of coupe I; *West*—Northwards along the eastern boundary of coupe I to the starting point.	The Gummuluru-Virannapalem-Kopalli-Kannapuram cart-track.
		IV. THE PULIRAMUDUGUDEM FELLING SERIES.	
I	4,695	Kopalli reserve west of the main ridge— *Boundaries.*—*North*—Starting from the extreme northern boundary of the Kopalli reserve, along the northern boundary until it meets the boundary line of coupe II of the Munjulur series; *East*—Thence southwards along the western boundary of coupe II of the Munjulur felling series to the south-west corner of this coupe, thence southwards along the main ridge past Kota Muriam 1837 to the boundary line; *South* and *West*—Thence along the western boundary of Kopalli reserve to the starting point.	The Dandipudi-Kannapuram cart-track.
II	2,624	The portion of Kopalli reserve lying between the Marajalli Kalava and the Chamanpalle-Puliramudugudem foot-path— *Boundaries.*—*North*—Starting at the south-west corner of coupe II of the Munjulur series, along the Marajalli Kalava till it meets the boundary line; *East* and *South*—Thence southwards and westwards along the boundary line until it meets the foot-path from Puliramudugudem to Chamanpalle, thence in a south-westerly direction along this foot-path until it meets the eastern boundary of coupe I; *West*—Thence northwards along the eastern boundary of coupe I to the starting point.	1 The Munjulur-Puliramudugudem-Kannapuram cart-track. 2 The Puliramudugudem Savallapullimuriam cart-track.
III	3,453	The southern end of Kopalli reserve— *Boundaries.*—*North*—Starting from the south-west corner of coupe II, along the Chamanpalle-Puliramudugudem foot-path to the boundary line; *East* and *South*—Thence along the reserve boundary to the south-west corner of the reserve; *West*—Thence northwards along the reserve boundary and the eastern boundary of coupe I to the starting point.	1 The Puliramudugudem-Kannapuram cart-track. 2 The Atchayyapalem-Kannapuram cart-track.
		V. THE KOVVADA FELLING SERIES.	
I	2,395	The portion of Kovvada block I between the Virannapalem enclosure and the Pedda Kalava, and the arm of the reserve beyond the Pedda Kalava— *Boundaries.*—*North*—Starting from the point at which the Kopalli-Virannapalem foot-path cuts the boundary of Kovvada block I, along the foot-path to the boundary of Virannapalem enclosure, thence in a south-easterly direction along the boundary of the enclosure until it meets the Virannapalem-Lakshminarayanadevapeta foot-path, thence along the foot-path for about 20 chains to a saddle; *East*—Thence southwards to clinometric height 1,360, eastwards to clinometric height 1,430, and thereafter in a general southerly direction along the Ralla Konda ridge to a saddle between clinometric heights 1,290 and 1,270; *South*—Thence north-west and west along a stream until it meets the Pedda Kalava, thence along the Pedda Kalava until it meets the reserve boundary, thence the reserve boundary; *West*—The reserve boundary to the starting point.	1 The Virannapalem-Kannapuram cart-track. 2 The Lankapalli-Kamayya Kunta-Rajanagaram cart-track.
II	3,109	The portion of Kovvada block I lying south of Gummuluru and east and south-east of Virannapalem. *Boundaries.*—*North*—Starting from the point where the Gummuluru-Virannapalem foot-path cuts the Virannapalem enclosure line, along this foot-path to point 730 on the boundary line; *East* and *South*—Thence along the reserve boundary line to a point on the line 21 chains west of clinometric height 477, thence in a north-westerly direction along a stream to a saddle which forms the south-eastern boundary of coupe I; *West*—Thence northwards along the eastern boundary of coupe I to the starting point.	1 The Virannapalam-Kopalli-Kannapuram cart-track. 2 The Virannapalem-Lakshminarayana-devipeta cart-track. 3 The Virannapalem-Dondapudi cart-track.

Coupe number. (1)	Area in acres. (2)	Location and boundaries. (3)	Main extraction routes. (4)
		V. THE KOVVADA FELLING SERIES—*cont.*	
III	2,910	The southern extremity of Kovvada block I— *Boundaries.—North*—Starting from the point at which the Pedda Kalava cuts the reserve boundary line about 55 chains north of Lankapalli, along the southern boundary of coupe I to the saddle between clinometric heights 1,270 and 1,290, and thence along a stream to the south-west corner of coupe II ; *East, South* and *West*—The boundary line of Kovvada block II back to the starting point.	1 The Lankapalli-Kamayya Kunta-Rajanagaram cart-track. 2 The Lankapalli-Lakshmipuram cart-track.
		VI. THE MALLAVARAM FELLING SERIES.	
I	4,414	Mallavaram reserve west of the Kalujolla-Bhavaram cart-track— *Boundaries.—North*—Starting from the north-west corner of Mallavaram reserve, along the northern boundary to the point where the Kalujolla-Bhavaram cart-track meets the boundary line ; *East*—Thence along this cart-track till it meets the southern boundary of Mallavaram reserve ; *South* and *West*—Along the boundary of the reserve back to the starting point.	1 The Gokavaram-Jaggampeta road. 2 The Mallavaram-Makalagandi cart-track.
II	4,981	The whole of Tirumalayapalem reserve— *Boundaries.*—The boundaries of Tirumalayapalem reserve.	1 The Sudikonda-Tirumalayapalem cart-track. 2 The Barry road.
III	3,200	Mallavaram reserve east of the Kalujolla-Bhavaram cart-track— *Boundaries.—North, East* and *South*—Starting from the point where the Kalujolla-Bhavaram road meets the northern boundary of Mallavaram reserve, along the boundary of the reserve until it meets the same cart-track on the southern boundary line ; *West*—Thence along this cart-track to the starting point.	1 The Lingaram-Bhavaram-Jaggampeta cart-track. 2 The Lingaram-Yelleshwaram road.
		VII. THE LAKKONDA FELLING SERIES.	
I	3,283	Lakkonda reserve east of the Matlapadu-Vemulova cart-track— *Boundaries.—North, East* and *South*—Starting from the point where the Matlapadu-Vemulova cart-track meets the northern boundary of Lakkonda reserve, along the boundary until it meets the same cart-track along the southern boundary of Lakkonda reserve ; *West*—Thence along the cart-track to the starting point.	1 The Vemulova-Timmapuram cart-track. 2 The Timmapuram-Yelleshwaram road.
II	4,825	The whole of Sudikonda reserve— *Boundaries.*—The boundaries of Sudikonda reserve.	1 The Mallavaram-Sudikonda road.
III	8,882	Lakkonda reserve west of the Matlapadu-Vemulova cart-track— *Boundaries.—North*—Starting from the north-west corner of Lakkonda reserve, along the northern boundary until it meets the Matlapadu-Vemulova cart-track ; *East*—Thence along the cart-track until it meets the southern boundary of the reserve ; *South* and *West*—The reserve boundary back to the starting point.	1 The Chidipalem-Pidatamamidi-Kothapalli cart-track. 2 The Timmapuram-Yelleshwaram road.
		VIII. THE MOLLERU FELLING SERIES.	
I	3,546	Molleru reserve north of the footpath from Sivarampatnam to Krishnavaram— *Boundaries.—North* and *East*—Starting from the north-west corner of Molleru reserve, along the northern and eastern boundaries until it meets the footpath from Krishnavaram to Sivarampatnam ; *South*—Thence along this footpath until it meets the western boundary of Molleru reserve ; *West*—Thence along the reserve boundary to the starting point.	1 The Vemulova-Timmapuram cart-track. 2 The Timmapuram-Yelleshwaram road.
II	3,181	Molleru reserve between the Sivarampatnam-Krishnavaram footpath and the Ramadevapuram-Krishnavaram footpath— *Boundaries.—North*—Starting from the point where the Sivarampatnam-Krishnavaram road cuts the western boundary of Molleru reserve, along the footpath until it meets the eastern boundary of the reserve ; *East*—Thence the eastern boundary of Molleru reserve until it meets the footpath from Krishnavaram to Ramadevapuram ; *South*—Thence along the footpath until it meets the western boundary of Molleru reserve ; *West*—Thence the reserve boundary to the starting point.	1 The Molleru-Mallavaram-Rajapudi-Jaggampeta cart-track.
III	1,984	Molleru reserve south of the Ramadevapuram-Krishnavaram footpath— *Boundaries.—North*—Starting from the point where the Ramadevapuram-Krishnavaram footpath meets the western boundary of Molleru reserve, along the footpath till it meets the eastern boundary of the reserve ; *East, South* and *West*—Thence along the reserve boundary to the starting point.	1 The Lingaram-Yelleshwaram cart-track.

Coupe number. (1)	Area in acres. (2)	Location and boundaries. (3)	Main extraction routes. (4)
		IX. THE VIRABHADRAPURAM FELLING SERIES.	
I	4,000	Virabhadrapuram reserve north of the main ridge and north-east corner of the reserve— *Boundaries.*—(I-*a*)—*North* and *East*—Starting from the north-west corner of the reserve, along the north-west and part of the northern boundaries to the right angle bend in the line where the footpath from Kinaparti meets the reserve boundary; *South*—Thence due west for about 55 chains to the main ridge and in a south-westerly direction along the ridge to the reserve boundary line; *West*—Thence along the reserve boundary to the starting point. (I-*b*)—*North* and *East*—Starting from the point at which the path from Kinarparti meets the northern boundary line of the reserve, along the boundary line until it meets the same path on the eastern boundary of the reserve; *West*—Thence northwards along the same path to the starting point.	1 The Jaddangi-Yelleshwaram road. 2 The Virabhadrapuram-Timmapuram cart-track. 3 The Timmapuram-Yelleshwaram road.
II	4,960	Virabhadrapuram reserve south of the main ridge excluding coupe I-*b*— *Boundaries.*—*North*—Starting from the southernmost point of coupe I along the southern boundary of coupe I until it meets the reserve boundary line, thence along the reserve boundary to the north-west corner of coupe I-*b*; *East*, *South* and *West*—Thence along the western boundary of coupe I-*b*, and of the reserve boundary to the starting point.	1 The Jaddangi-Yelleshwaram road. 2 The Timmapuram-Yelleshwaram road.
III	6,880	The whole of Doramamidi reserve— *Boundaries.*—The boundaries of Doramamidi reserve.	1 The Doramamidi-Papempeta cart-track. 2 The Doramamidi-Jaddangi cart-track.
		X. THE LABBERTI FELLING SERIES.	
I	6,828	The whole of Labberti reserve— *Boundaries.*—The boundaries of Labberti reserve.	1 The Jaddangi-Yelleshwaram road. 2 The Anantagiri-Jaddangi cart-track.
II	1,837	The whole of Anantagiri reserve— *Boundaries.*—The boundaries of Anantagiri reserve.	1 The Jaddangi-Yelleshwaram road. 2 The Anantagiri-Jaddangi cart-track.
III	6,208	The whole of Singampalli and Ultimathula reserves— *Boundaries.*—The boundaries of these two reserves.	1 The Anantagiri-Jaddangi cart-track. 2 The Sarabhavaram-Rajavommangi-Yelleshwaram road.
		XI. THE BANADAPALLI FELLING SERIES.	
I	7,349	The whole of Lododdi reserve— *Boundaries.*—The boundaries of Lododdi reserve.	1 The Lododdi-Ramanayyapetta cart-track. 2 The Kimiligedda-Rajavommangi cart-track.
II	3,212	Banadapalli reserve, north of the Banadapalli Kalava— *Boundaries.*—*North* and *East*—Starting from the north-west corner of Banadapalli reserve boundary until it meets the Banadapalli Kalava; *South*—Thence along the Banadapalli Kalava until it meets the western boundary of the reserve; *West*—Thence along the boundary of the reserve to the starting point.	1 The Kothapalem-Banadapalli cart-track. 2 The Banadapalli-Rajavommangi road.
III	2,491	Banadapalli reserve south of the Banadapalli Kalava— *Boundaries.*—*North*—Starting from the point where the Banadapalli Kalava cuts the western boundary of the reserve, along this stream until it meets the eastern boundary of the reserve; *East*, *South* and *West*—Thence along the reserve boundary to the starting point.	1 The same as for coupe II.
		XII. THE AMINBADA FELLING SERIES.	
I	7,905	The whole of Rajavommangi reserve— *Boundaries.*—The boundaries of Rajavommangi reserve.	1 The Sarabhavaram-Rajavommangi-Jaddangi road.
II	2,752	The northern half of Aminbada reserve— *Boundaries.*—*North*—Starting from the north-west corner of the reserve along the northern boundary to the extreme northern point of the reserve; *East*—Thence south-east for about 38 chains until the line meets a stream; *South*—Thence along the stream to the main ridge, and along the main ridge in a general south-westerly direction past 1,639 to the reserve boundary line at a point south of clinometric height 1,000; *West*—Thence westwards to the starting point.	1 The Rajavommangi-Vatangi cart-track. 2 The Kumarapuram-Aminbada-Jaddangi cart-track. 3 The Rajavommangi-Yelleshwaram road.

Coupe number. (1)	Area in acres. (2)	Location and boundaries. (3)	Main extraction routes. (4)
		XII. THE AMINBADA FELLING SERIES—*cont.*	
III	2,356	The southern half of Aminbada reserve— *Boundaries.—North*—Starting from a bend in the line south of clinometric height 1,000 at the south-west of the reserve the boundary runs past 1,639 in a general north-easterly direction along the ridge and thence along a stream to a point on the boundary line about 38 chains south-east of the northern extremity of the reserve ; *East* and *South*—Thence along the boundary line to the starting point.	1 The Rajavommangi cart-track. 2 The Kumarapuram-Aminbada cart-track. 3 The Rajavommangi-Yelleshwaram road.
		XIII. THE VATANGI FELLING SERIES.	
I	3,850	The Vatangi reserve east of the cart-track from Lododdi to Vatangi, and part of the southern end of the central block— *Boundaries.*—(I-*a*)—*North*—Starting from the corner of the reserve where the Vatangi-Lododdi cart-track enters the reserve, along the cart-track till it leaves the reserve ; *East, South* and *West*—The reserve boundary to the starting point. (I-*b*)—*North*—Starting from point 1,827 on the main ridge, in a north-easterly direction along the main ridge till it meets a point in the same straight line as the line that forms the northern boundary of the re-entrant north of Vatangi ; thence in a straight line until it meets the reserve boundary at the north-west corner of this re-entrant ; *East*—The reserve boundary line ; *South*—The reserve boundary line to a point south of clinometric height 1,364 ; *West*—To clinometric height 1,364 and thence along the ridge to the starting point.	1 The Lododdi-Vatangi cart-track. 2 The Vatangi-Ramanayyapeta cart-track.
II	2,929	The main block of Vatangi reserve lying between the main ridge and the Vatangi-Lododdi cart-track— *Boundaries.—North*—Starting from the northern-most point of Vatangi reserve, along the reserve boundary until it meets the Lododdi-Vatangi cart-track ; *East*—The Lododdi-Vatangi cart-track until it meets the reserve boundary line ; *South*—Westwards along the reserve boundary line and in a straight line in continuation thereof to the north-west corner of coupe I-*b* ; *West*—Thence in a north-easterly direction along the main ridge to the starting point.	1 The Lododdi-Vatangi cart-track. 2 The Vatangi-Ramanayyapeta cart-track.
III	1,855	Vatangi reserve west of the main ridge— *Boundaries.—North*—Starting from the north-west corner of the reserve along the northern boundary to the northern-most point of the reserve ; *East*—Thence in a general south-westerly direction along the main ridge to the reserve boundary line at the south-west corner of coupe I-*b* ; *South* and *West*—Along the reserve boundary line to the starting point.	1 The same as coupes I and II.
		XIV. THE LINGAMPARTI FELLING SERIES.	
I	4,301	The whole of Peddagarangi reserve— *Boundaries.*—The boundaries of Peddagarangi reserve.	The Vatangi-Ramanayyapeta cart-track.
II	6,618	The whole of Lingamparti reserve— *Boundaries.*—The boundaries of Lingamparti reserve.	The Lingamparti-Yelleshwaram road.
III	14,342	The whole of Raghavapatnam and Sarlanka reserves— *Boundaries.*—The boundaries of these two reserves.	The Raghavapatnam-Sambhavaram cart-track.
		XV. THE JADDANGI FELLING SERIES.	
I	2,317	Jaddangi reserve west of the Vanakarayi Kalava— *Boundaries.—North* and *East*—Starting from the north-west corner of the reserve alongside the Jaddangi-Yelleshwaram road, along the reserve boundary until it meets the Vanakarayi Kalava, thence along the Vanakarayi Kalava until it meets the southern boundary of the reserve to the right angle turn alongside the Jaddangi-Yelleshwaram road ; *West*—Thence along the reserve boundary to the starting point.	The Jaddangi-Yelleshwaram road.
II	3,251	Jaddangi reserve east of the Vanakarayi Kalava— *Boundaries.—North, East* and *South*—Starting from the Vanakarayi Kalava meets the northern boundary of the reserve along the reserve boundary to the point where the same Kalava cuts the southern boundary of the reserve ; *West*—Thence along the Vanakarayi Kalava northwards to the starting point.	1 The Jaddangi-Yelleshwaram road. 2 The Vatangi-Ramanayyapeta cart-track.
III	10,184	The whole of Vuligogula reserve— *Boundaries.*—The boundaries of Vuligogula reserve.	The Vuligogula-Dasapalli path.
		XVI. THE ANNAVARAM FELLING SERIES.	
I	2,061	The north-east quarter of Annavaram reserve— *Boundaries.—North* and *East*—Starting from the point where a feeder of the Donigedda cuts the northern boundary of Annavaram reserve at a point due north of hill 1098, along the reserve boundary line to the point where	1 The Vatangi-Ramanayyapeta cart-track. 2 The Jaddangi-Yelleshwaram road.

Coupe number. (1)	Area in acres. (2)	Location and boundaries. (3)	Main extraction routes (4)
		XVI. THE ANNAVARAM FELLING SERIES—*cont.*	
		the stream that flows past Maredubaka village cuts the boundary line; *South*—Thence westwards along this stream to the saddle between hills 1,045 and 1,306, thence westwards along the stream converging on the Puligogulapadu-Urlakulapadu footpath; *West*—Thence in a north-westerly sweep along this stream to the starting point.	
II	2,752	The south-west quarter of Annavaram reserve— *Boundaries.—North*—Starting from the south-west corner of coupe I, along the southern boundary of coupe I to the reserve boundary; *East* and *South*—The reserve boundary until it meets the stream running south-west from hill 1,786 to Annavaram village; *West*—Up this hill stream in a north-east direction to hill 1,786 and down another hill stream in the same direction to the starting point.	1 The Vatangi-Ramanayyapeta cart-track. 2 The Jaddangi-Yelleshwaram road.
III	3,494	The western half of Annavaram reserve— *Boundaries.—North*—Starting from the north-west corner of the reserve, along the northern boundary of the reserve to the north-west corner of coupe I; *East*—Thence southwards along the western boundaries of coupes I and II to the reserve boundary; *West*—Thence along the reserve boundary to the starting point.	1 The Jaddangi-Yelleshwaram road.

SECTION 4.—METHOD OF TREATMENT.

394. *The silvicultural considerations.*—The chief considerations that bear on the method of treatment are—

(1) the intensity of felling;
(2) the method of felling; and
(3) the height at which the culms may be cut.

Each will be dealt with separately.

395. *The intensity of felling.*—It is well-known that clear-felling bamboo clumps results in the formation of whips, the decay of the rhizomes, and general deterioration; and that it is necessary to retain sufficient old culms, to provide mechanical support to the new culms, and to maintain the productive vigour of the rhizomes. It is inadvisable to prescribe a definite number of culms to be left in a clump at each cutting, as the number prescribed will be too high for some clumps and too low for others. All new culms will be retained; and the number of old culms to be retained in a clump will depend on the size of the clump and the number of new culms. In his 'Report on the forests of the Mahanadi basin' Mr. J. W. Nicholson estimates the average annual production of new culms at one-sixth to one-seventh of the growing stock, under conditions that are not unlike those that prevail in the Lower Godavari division; and this figure would, in normal years, be a fair estimate for the forests included in this working circle. It has been suggested that the number of old culms to be retained in a clump, worked on a felling cycle of three years should be twice the number of new culms (Mr. H. Trotter, Indian Forester, Volume XLVIII, page 600). This appears to be a suitable proportion and may be accepted. Therefore in a clump containing 18 culms, on an average there will be 3 new culms, and the number of old culms to be retained will be 6, leaving 9 culms for removal. Consequently under normal conditions a half of the number of culms in a clump will be available for felling.

396. *The method of felling.*—Most bamboo forests are worked on a method which may be loosely described as economic thinning: the idea being to retain all the new culms and a certain number or proportion of old culms, the bamboos for the market being obtained by thinning out the clumps as evenly as possible. In actual practice it is not easy to thin a clump satisfactorily; and when this operation is left to bamboo cutters working over large areas with very little supervision or control, it naturally degenerates into irregular hacking, the main consideration being the extraction of as large a number of well shaped culms as possible. The clumps are generally over-felled; and as fellings are frequently concentrated around the new culms they often bend and collapse for want of support. Although no final decision has yet been reached on the best method of working *Dendrocalamus strictus* and *Bambusa arundinacea*, judicious thinning of the clumps appears to be the best silvicultural treatment. But this is not practicable where extensive areas are worked by unskilled labour without supervision. It has long been known that when a clump is established it tends to develop in the direction most favourable for its growth; and that there are generally more new culms in one half of a clump than in the other: on the slopes of the Lower Godavari division more new culms are generally found in the upper half of the clumps. It is also known that heavy felling along part of the circumference of a clump retards the growth in that direction, and that a clump should be encouraged to grow in the direction that it is extending naturally. It has already been shown that one half of the

culms in a clump may be removed. Therefore it is desirable to restrict fellings to the older half of each clump, namely, the half that is diametrically opposite to the direction in which the clump is extending as indicated by the new culms. The new culms will thus be provided with the mechanical support that they need, and the growing ends of the rhizomes will be protected. No restriction will be placed on fellings in the older half of each clump, and it may be clear-felled ; but in actual practice the poorer culms will be left standing. This method has been tried in other parts of India with varying success. Therefore the prescriptions are tentative and will be reconsidered at the end of the first felling cycle. In order to re-establish the clumps that have been over-felled and need rest, fellings will not be permitted in any clump that contains less than 10 culms.

397. *The height at which the culms may be cut.*—It has been proved that the height at which culms are cut is of no special importance, and so it is unnecessary to place any restrictions on the height at which the culms may be felled by contractors. It is customary in the *Bambusa* forests of Gokavaram and Peddapur ranges to fell the upper half of the culms at the season of the year when sugar cane props are in demand, and to remove the lower halves of the culms later if they are saleable ; and frequently only the lower halves of the culms are removed leaving the upper half entangled in the clump. This is injurious and undesirable under the present method of working, but it will do little harm when fellings are restricted to a half of each clump. Although high felling is not prohibited, it leaves the clumps in an untidy mess, and should be discouraged by the District Forest Officer who should endeavour to get the contractor to fell low ; about 18 inches above ground level.

398. *The felling rules.*—Under the conditions that prevail in the Lower Godavari division, the felling rules should be few and simple, so that the bamboo cutters will understand what is prohibited, and breaches of the rules may be detected easily. There are only two felling rules :—

(1) Fellings will not be permitted in any clump that contains *less* than 10 culms.
(2) Fellings will be restricted to a half of each clump—the half that is diametrically opposite to the largest number of new culms.

399. *The tabular statement of fellings.*—The following statement shows the order of felling in each series :—

FELLING STATEMENT.

A. Polavaram Range.

Year of felling.	1. Ravigudem Felling Series.					2. Kotrupalli Felling Series.				
	Coupe number.	Area under bamboo (approximate).		Total area.	Number of units.	Coupe number.	Area under bamboo (approximate).		Total area.	Number of units.
		D.S.	B.A.				D.S.	B.A.		
		ACS.	ACS .	ACS.			ACS.	ACS.	ACS.	
1934–35 ..	I	1,742	Nil.	2,196	261	I	1,270	3	2,070	254
1935–36 ..	II	1,434	4	1,438	214	II	1,219	Nil.	1,230	243
1936–37 ..	III	1,545	83	1,628	231	III	1,883	Nil.	2,206	280
1937–38 ..	I	1,742	Nil.	2,196	261	I	1,270	3	2,070	254
1938–39 ..	II	1,434	4	1,438	214	II	1,219	Nil.	1,230	243
1939–40 ..	III	1,545	83	1,628	231	III	1,883	Nil.	2,206	280
1940–41 ..	I	1,742	Nil.	2,196	261	I	1,270	3	2,070	254
1941–42 ..	II	1,434	4	1,438	214	II	1,219	Nil.	1,230	243
1942–43 ..	III	1,545	83	1,628	231	III	1,883	Nil.	2,206	280
1943–44 ..	I	1,742	Nil.	2,196	261	I	1,270	3	2,070	254

Year of felling.	3. Munjulur Felling Series.					4. Puliramudugudem Felling Series.				
	Coupe number.	Area under bamboo (approximate).		Total area.	Number of units.	Coupe number.	Area under bamboo (approximate).		Total area.	Number of units.
		D.S.	B.A.				D.S.	B.A.		
		ACS.	ACS.	ACS.			ACS.	ACS.	ACS.	
1934–35 ..	I	2,552	34	2,594	382	I	2,906	Nil.	4,698	435
1935–36 ..	II	2,844	Nil.	3,205	426	II	2,209	30	2,624	330
1936–37 ..	III	3,690	Nil.	3,906	553	III	2,080	12	3,453	312
1937–38 ..	I	2,552	34	2,594	382	I	2,906	Nil.	4,698	435
1938–39 ..	II	2,844	Nil.	3,205	426	II	2,209	30	2,624	330
1939–40 ..	III	3,690	Nil.	3,906	553	III	2,080	12	3,453	312
1940–41 ..	I	2,552	34	2,594	382	I	2,906	Nil.	4,698	435
1941–42 ..	II	2,844	Nil.	3,205	426	II	2,209	30	2,624	330
1942–43 ..	III	3,690	Nil.	3,906	553	III	2,080	12	3,453	312
1943–44 ..	I	2,552	34	2,594	382	I	2,906	Nil.	4,698	435

Year of felling.	5. Kovvada Felling Series.				
	Coupe number.	Area under bamboo (approximate).		Total area.	Number of units.
		D.S.	B.A.		
		ACS.	ACS.	ACS.	
1934–35	I	2,206	22	2,395	330
1935–36	II	2,559	Nil.	3,109	381
1936–37	III	1,314	544	2,910	262
1937–38	I	2,206	22	2,395	330
1938–39	II	2,559	Nil.	3,109	381
1939–40	III	1,314	544	2,910	262
1940–41	I	2,206	22	2,395	330
1941–42	II	2,559	Nil.	3,109	381
1942–43	III	1,314	544	2,910	262
1943–44	I	2,206	22	2,395	330

D.S. = *Dendrocalamus strictus.*

B.A. = *Bambusa arundinacea.*

B. Gokavaram Range.

Year of felling.	6. Mallavaram Felling Series.					7. Lakkonda Felling Series.				
	Coupe number.	Area under bamboo (approximate).		Total area.	Number of units.	Coupe number.	Area under bamboo (approximate).		Total area.	Number of units.
		D.S.	B.A.				D.S.	B.A.		
		ACS.	ACS.	ACS.			ACS.	ACS.	ACS.	
1934–35	I	9	1,519	4,414	196	I	974	321	3,283	227
1935–36	II	23	1,440	4,981	231	II	28	1,103	4,825	205
1936–37	III	Nil.	1,030	3,200	176	III	1,967	90	8,882	213
1937–38	I	9	1,519	4,414	196	I	974	321	3,283	227
1938–39	II	23	1,440	4,981	231	II	28	1,103	4,825	205
1939–40	III	Nil.	1,030	3,200	176	III	1,967	90	8,882	213
1940–41	I	9	1,519	4,414	196	I	974	321	3,283	227
1941–42	II	23	1,440	4,981	231	II	28	1,103	4,825	205
1942–43	III	Nil.	1,030	3,200	176	III	1,967	90	8,882	213
1943–44	I	9	1,519	4,414	196	I	974	321	3,283	227

Year of felling.	8. Molleru Felling Series.					9. Virabhadrapuram Felling Series.				
	Coupe number.	Area under bamboo (approximate).		Total area.	Number of units.	Coupe number.	Area under bamboo (approximate).		Total area.	Number of units.
		D.S.	B.A.				D.S.	B.A.		
		ACS.	ACS.	ACS.			ACS.	ACS.	ACS.	
1934–35	I	639	677	3,546	200	I	467	1,430	4,000	289
1935–36	II	385	1,168	3,181	243	II	1,760	754	4,960	287
1936–37	III	5	1,233	1,984	178	III	2,335	494	6,880	365
1937–38	I	639	677	3,546	200	I	467	1,430	4,000	289
1938–39	II	385	1,168	3,181	243	II	1,760	754	4,960	287
1939–40	III	5	1,233	1,984	178	III	2,335	494	6,880	365
1940–41	I	639	677	3,546	200	I	467	1,430	4,000	289
1941–42	II	385	1,168	3,181	243	II	1,760	754	4,960	287
1942–43	III	5	1,233	1,984	178	III	2,335	494	6,880	365
1943–44	I	639	677	4,546	200	I	467	1,430	4,000	289

C. Peddapur Range.

Year of felling.	10. Labberti Felling Series.					11. Banadapalli Felling Series.				
	Coupe number.	Area under bamboo (approximate).		Total area.	Number of units.	Coupe number.	Area under bamboo (approximate).		Total area.	Number of units.
		D.S.	B.A.				D.S.	B.A.		
		ACS.	ACS.	ACS.			ACS.	ACS.	ACS.	
1934–35	I	2,119	12	6,828	299	I	1,286	Nil.	7,349	184
1935–36	II	1,524	6	1,837	213	II	2,022	Nil.	3,212	382
1936–37	III	2,751	Nil.	6,208	358	III	1,884	Nil.	2,491	277
1937–38	I	2,119	12	6,828	299	I	1,286	Nil.	7,349	184
1938–39	II	1,524	6	1,837	213	II	2,022	Nil.	3,212	382
1939–40	III	2,751	Nil.	6,208	358	III	1,884	Nil.	2,491	277
1940–41	I	2,119	12	6,828	299	I	1,286	Nil.	7,349	184
1941–42	II	1,524	6	1,837	213	II	2,022	Nil.	3,212	382
1942–43	III	2,751	Nil.	6,208	358	III	1,884	Nil.	2,491	277
1943–44	I	2,119	12	6,828	299	I	1,296	Nil.	7,349	184

Year of felling.	12. Aminbada Felling Series.					13. Vatangi Felling Series.				
	Coupe number.	Area under bamboo (approximate).		Total area.	Number of units.	Coupe number.	Area under bamboo (approximate).		Total area.	Number of units.
		D.S.	B.A.				D.S.	B.A.		
		ACS.	ACS.	ACS.			ACS.	ACS.	ACS.	
1934–35	I	2,107	Nil.	7,905	264	I	2,015	Nil.	3,850	241
1935–36	II	920	18	2,356	200	II	1,699	Nil.	2,929	342
1936–37	III	1,252	Nil.	2,752	203	III	1,050	Nil.	1,855	238
1937–38	I	2,107	Nil.	7,905	264	I	2,015	Nil.	3,850	241
1938–39	II	920	18	2,356	200	II	1,699	Nil.	2,929	342
1939–40	III	1,252	Nil.	2,752	203	III	1,050	Nil.	1,855	238
1940–41	I	2,107	Nil.	7,905	264	I	2,015	Nil.	3,850	241
1941–42	II	920	18	2,356	200	II	1,699	Nil.	2,929	342
1942–43	III	1,252	Nil.	2,752	203	III	1,050	Nil.	1,855	238
1943–44	I	2,107	Nil.	7,905	264	I	2,015	Nil.	3,850	241

Year of felling.	14. Lingamparti Felling Series.					15. Jaddangi Felling Series.				
	Coupe number.	Area under bamboo (approximate).		Total area.	Number of units.	Coupe number.	Area under bamboo (approximate).		Total area.	Number of units.
		D.S.	B.A.				D.S.	B.A.		
		ACS.	ACS.	ACS.			ACS.	ACS.	ACS.	
1934–35	I	1,174	Nil.	4,301	161	I	1,195	52	2,317	219
1935–36	II	1,489	958	6,617	272	II	2,851	Nil.	3,251	290
1936–37	III	1,914	Nil.	11,782	410	III	732	395	10,229	179
1937–38	I	1,174	Nil.	4,301	161	I	1,195	52	2,317	219
1938–39	II	1,489	958	6,617	272	II	2,851	Nil.	3,251	290
1939–40	III	1,914	Nil.	11,782	410	III	732	395	10,229	179
1940–41	I	1,174	Nil.	4,301	161	I	1,195	52	2,317	219
1941–42	II	1,489	958	6,617	272	II	2,851	Nil.	3,251	290
1942–43	III	1,914	Nil.	11,782	410	III	732	395	10,229	179
1943–44	I	1,174	Nil.	4,301	161	I	1,195	52	2,317	219

Year of felling.	16. Annavaram Felling Series.				
	Coupe number.	Area under bamboo (approximate).		Total area.	Number of units.
		D.S.	B.A.		
		ACS.	ACS.	ACS.	
1934–35	I	1,677	18	2,061	253
1935–36	II	1,300	162	2,752	288
1936–37	III	3,145	170	3,494	293
1937–38	I	1,677	18	2,061	253
1938–39	II	1,300	162	2,752	288
1939–40	III	3,145	170	3,494	293
1940–41	I	1,677	18	2,061	253
1941–42	II	1,300	162	2,752	288
1942–43	III	3,145	170	3,494	293
1943–44	I	1,677	18	2,061	253

D.S. = *Dendrocalamus strictus*. B.A. = *Bambusa arundinacea*.

SECTION 5.—OTHER REGULATIONS.

400. *The period of lease.*—At present the bamboo coupes are sold annually. It will probably prove beneficial both to the contractors and the Forest department if the coupes are sold in felling series, the period of the lease being three years. This will give the bamboo contractors a better control of the local markets, and it will enable them to lay out money in improving the cart-tracks. If the felling series are leased in accordance with this suggestion, it will still be necessary to fell the coupes in proper sequence, within the year prescribed for each coupe. Extensions of time for felling coupes should be granted only under exceptional circumstances which will be explained in the remarks column of the control book.

401. *Emergency regulations in the event of gregarious flowering.*—If gregarious flowering takes place within any reserve during the period of this working plan, the District Forest Officer will inspect the reserve to decide whether it is necessary to close parts of the reserve to grazing in the interests of the new crop of bamboo ; and he will arrange for such closure as is necessary and practicable, in consultation with the Collector and Conservator.

402. *Grazing regulations.*—Except for the restrictions that may be necessary under the prescriptions of the previous paragraph, the entire working circle will be open to grazing, except such areas as are closed to grazing in the working circles that are overlapped by the Bamboo Working Circle.

403. *Fire-protection.*—No special fire-protection is necessary for the Bamboo Working Circle. It will be protected under the general prescriptions for fire-protection in Chapter XII.

SECTION 6.—CONTROL.

404. *Control records.*—The following control records will be maintained :—

(1) The control book.
(2) The control journal.

The outturn in the control book will be compiled from the monthly returns furnished by the contractors on or before the 15th of each month. These returns will show the outturn of each class of bamboo and the total removals. Sample control forms will be found in Appendix VIII.

CHAPTER X.—WORKING PLAN FOR THE MINOR PRODUCTS WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION OF THE WORKING CIRCLE.

405. *Extent.*—The Minor Products Working Circle includes the entire area covered by this working plan, namely, 296,547·4 acres or 463·36 square miles.

406. *The minor products of the Lower Godavari division.*—The chief minor products of the Lower Godavari division are—

(*a*) *Tanning barks—Thangedu—Cassia auriculata, and Rela—Cassia fistula.—Thangedu and Rela* are found in all four ranges of the division.

(*b*) *Tanning fruits.*—Karaka—Myrabolams—the fruit of *Terminalia chebula,* found chiefly in the Agency forests of Peddapur, Gokavaram and Polavaram ranges.

(*c*) *Tanning leaves.*—Jaji leaves—*Woodfordia floribunda,* are collected in parts of Peddapur and Gokavaram ranges and are used for tanning.

(*d*) *Dyes.*—(1) The bark of Gedara—*Ceriops roxburghiana,* found in the mangrove swamps and used for dyeing fishing nets ; and

(2) the fruit of Vasantagunda—*Mallotus philippinensis,* found chiefly in the Agency forest of Peddapur range. It is used for dyeing silk yellow and produces the red Kunkuma or Kamala powder.

(*e*) *Oil seeds.*—The seeds of Kanuga—*Pongamia glabra,* found along water courses throughout the forests of the Agency.

(*f*) *Drugs—The seeds of Musti—Strychnos nux-vomica.*—This species is very common on tank bunds and low-lying ground in Peddapur, Gokavaram and Polavaram ranges.

(*g*) *Edible fruits.—Chintapandu*—Tamarind, is very plentiful throughout the Agency and is the chief minor product of the division.

(*h*) *Grasses.*—(1) Thatching and fodder grass is unsaleable in the forests of the Uplands and the Agency, but is sold in the coastal forests of Coringa, Coringa Extension, Kandikuppa and Upputeru. These grasses are plentiful in the large blanks west of the Dongapandi in Upputeru reserve.

(2) Kopra gaddi—Bhaber grass—*Ischœmum angustifolium*, is common in the broken ground in the Agency forests of Peddapur, Gokavaram and Polavaram ranges. It is used for making ropes.

(*i*) *Animal products.*—Horns, skins, honey and wax are collected in the uplands and the Agency by the hill tribes.

(*j*) *Miscellaneous products.*—The chief miscellaneous products are—

(1) palmyra leaves, used for thatching,
(2) the leaves of Adda theega—*Bauhinia Vahlii*, used as plates found chiefly in the Polavaram range,
(3) marking nuts, the fruit of Nalla-jeedi-ginjalu—*Semecarpus anacardium*, found in the Agency forests of Peddapur, Gokavaram and Polavaram ranges,
(4) clearing nuts, Indupu Kayalu, the seeds of *Strychnos potatorum*, found in the Agency forests throughout the division,
(5) soap nut—Kunkudu Kayalu, the fruit of *Sapindus emarginatus*, found in Peddapur, Gokavaram and Polavaram ranges, and
(6) various mineral products such as lime-stone and gravel.

407. *Methods of collection and disposal.*—At present three methods of collection and disposal are in use—

(1) by lease to contractors,
(2) by levying seigniorage fees on produce collected by Koyas and Reddies and others, at the markets where this produce is sold, and
(3) by the sale of permits for certain classes of produce.

408. *Leases to contractors.*—The right to collect and remove the following produce within specified areas is leased annually to contractors :—

Thangedu bark, Rela bark when it is saleable, Gedara bark, thatching and fodder grass in the coastal reserves, Nux-vomica, Kanuga seeds and the fruit of Vasanta-gunda—*Mallotus philippinensis*.

409. *Produce on which seigniorage is levied.*—Seigniorage fees are levied on the following produce collected and sold by the Agency tribes :—

Tamarind, Myrabolams, honey, wax, marking nuts, clearing nuts, soap nuts, etc.

410. *Produce sold on permits.*—Permits are issued on payment, for the removal of the following produce :—

Palmyra leaves, thatching grass, lime-stone, gravel, rough stone, etc., whenever such produce is in demand.

SECTION 2.—METHOD OF TREATMENT.

411. *General remarks.*—As the demand for minor products varies within short periods and the prices fluctuate greatly, it is undesirable to lay down definite prescriptions in the working plan for the collection and disposal of such produce. The District Forest Officer is expected to harvest and market his minor forest produce as advantageously as possible, making the necessary response and adjustments to the fluctuations that may occur from time to time. But certain matters which appear to need attention are referred to below, with suggestions on the action that appears necessary.

412. *Tamarind.*—Tamarind is one of the most important minor products in the Lower Godavari division, and it is one of the chief commodities exported from the Agency. Tamarind groves are a feature of nearly all the villages in the Agency, and they are a fruitful source of revenue. A large number of these groves are overmature, and nothing, or very little, is being done to replace them. The District Forest Officer, with the assistance of the Revenue officers, should encourage the Koyas and Reddis to plant new groves on suitable ground. Unless new groves are planted, soon there will be a heavy drop in the supplies of tamarind in the next 30 or 40 years.

413. *Gedara bark.*—The bark of Gedara—*Ceriops roxburghiana*—is in great demand in the fishing villages that border on the mangrove swamps of Rajahmundry range. It is used for dyeing fishing nets. The present method of working appears to be somewhat haphazard. The correct rotation, and the best method of removing the bark need investigation if the supplies are to be maintained.

414. *Fodder and thatching grass.*—Upputeru reserve, west of the Dongapandi, produces a very good crop of grass in the cold weather ; and it ought to be possible to obtain a higher revenue from this grass.

415. *The privileges of the Agency tribes.*—In any schemes that may be initiated for increasing the revenue obtained from minor forest produce, it is inadvisable to restrict or curtail the privileges that are enjoyed by the Agency tribes. The middle man from the plains is the *bete noire* of the Agency and it is against him that reorganization can best be directed.

SECTION 3.—CONTROL.

416. *The control book.*—Although no prescriptions are laid down in the working plan for the harvesting and disposal of minor forest produce, and this is left to the discretion of the controlling and administration staff, nevertheless it is desirable that a record should be maintained of what is being done each year and the results obtained. A control book for this working circle will be maintained in the form shown in Appendix VIII.

CHAPTER XI.—WORKING PLAN FOR THE GRAZING WORKING CIRCLE.

SECTION 1.—CONSTITUTION OF THE WORKING CIRCLE.

417. *Extent.*—The Grazing Working Circle includes the whole area covered by this working plan except—

(1) certain specially protected areas which will be permanently closed to grazing; and

(2) certain felled coupes which will be closed to grazing for fixed periods.

The maximum area that will be closed to grazing, in the ordinary course, during the period of this working plan, will be about 19,222 acres—approximately 6·5 per cent of the total area of the division—leaving 277,325 acres open to grazing.

418. *Specially protected areas permanently closed to grazing.*—The following areas will be permanently closed to grazing :—

(1) The specially protected compartments in Coringa Extension reserve, namely,—1 (*a*), 1 (*b*), 2 (*b*), 22 (*b*), 22 (*c*), 22 (*d*), 22 (*e*), 22 (*f*), 22 (*g*) and 23 (*b*), with a total area of 2,357 acres.

(2) The Kandikuppa Sector of the Mangrove Clear-felling Working Circle, comprising compartments 4, 5, 6, 7, 8 and 9 of Kandikuppa reserve with a total area of 3,911 acres.

(3) The regenerated coupes in the Beddadanole felling series of the Timber Clear-felling Working Circle comprising compartments 8 to 18 of Beddadanole reserve, and coupes I to X as they are felled. The area will range from 718 acres in 1934, to 1,054 acres in 1943, the maximum area closed to grazing during the period of the plan being 1,054 acres.

(4) The regenerated coupes in the Puliramudugudem felling series of the Timber Clear-felling Working Circle, comprising—

(*a*) Kopalli reserve, compartments 3 to 16, and coupes I, II, IV and V as they are felled. The area will range from 639 acres in 1934, to 735 acres in 1938 ; and

(*b*) Kovvada block I, coupes II, VI, VII, IX and X as they are felled. The area will range from nil, to 147 acres in 1943.

The maximum area closed to grazing in this felling series during the period of the plan will be 882 acres.

(5) The plantations in the Teak Conversion Working Circle, comprising—

(*a*) Banadapalli reserve, coupes I to X as they are felled. The area will range from 11 acres in 1934, to 113 acres in 1943,

(*b*) Sudikonda reserve, coupes I, II, IV, V, VIII and X as they are felled. The area will range from 13 acres in 1934, to 72 acres in 1943, and

(*c*) Tirumalayapalem reserve, coupes II, III, VI and VII as they are felled. The area will range from nil in 1934, to 33 acres in 1940.

The maximum area closed to grazing in this working circle during the period of the plan will be 218 acres.

(6) The areas that have been artificially regenerated in the Papikonda Experimental Working Circle. The maximum area that will be closed to grazing in this working circle during the period of this plan will be about 150 acres in Papikonda reserve, and about 100 acres in Kovvada block II, the total area being 250 acres.

The aggregate maximum area that will be specially protected and closed to grazing during the period of this working plan will be 8,672 acres.

419. *Periodic closure to grazing.*—The period for which felled coupes are closed to grazing differs. In the Coringa Sector of the Mangrove Clear-felling Working Circle, and in the Mangrove Coppice Working Circle, coupes are closed to grazing during the year of felling and thereafter for five years. In the Casuarina Plantation Working Circle all plantations are closed to grazing until the end of the fourth year. In the Upland Coppice Working Circle, all coupes are closed to grazing for ten years : this period includes the year of felling.

The following statement shows the maximum areas that will be closed to grazing in the reserved forests of the Lower Godavari division during the period of the working plan :—

Range.	Reserved forest.	Area in acres.	Maximum area in acres ordinarily closed to grazing.				Remarks.
			Permanent.	Periodic.	Total.	Percentage.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Polavaram ..	Beddadanole	14,717·0	1,054	..	1,054	7·1	1. These figures include coupes felled under old schemes, but still in need of protection from grazing.
	Kopalli	14,863·7	735	..	735	5·0	
	Kovvada, I	14,388·2	147	..	147	1·0	
	Kovvada, II	2,592·0	100	..	100	3·9	
	Papikonda	10,890·9	150	..	150	1·4	
Peddapur ..	Banadapalli	5,703·0	113	..	113	2·0	
Gokavaram ..	Sudikonda	4,824·0	72	630	702	14·5	
	Tirumalayapalem ..	4,980·6	33	940	974	19·7	
	Mallavaram	7,614·0	..	512	512	6·8	
Rajahmundry ..	Coringa	10,483·2	..	1,950	1,950	18·5	
	Coringa extension ..	48,176·2	2,357	3,280	5,637	11·9	
	Kandikuppa	8,708·6	3,911	312	4,223	48·5	2. The figures for Kandikuppa reserve include the Casuarina Plantation Working Circle.
	Upputeru	10,826·4	..	2,110	2,110	19·5	
	Devancheruvu, I and II.	2,088·9	..	816	816	38·9	
Polavaram, Peddapur and Gokavaram ranges.	Other reserves not closed to grazing.	135,690·7	..	..	..	..	
	Divisional totals ..	**296,547·4**	**8,672**	**10,550**	**19,223**	6·5	

420. *Comparison with closure to grazing under the current schemes.*—The maximum area that will be closed to grazing under the prescriptions of this working plan will be about 10,600 acres less than the total area closed under the current schemes. This is explained as follows :—

(1) Under the current scheme, two felling series in Coringa Extension reserve, with an aggregate area of 13,640 acres, are permanently closed to grazing. This prescription has long been a dead letter, and cattle graze freely throughout these two felling series. Instead of complete closure of part of the working circle, the whole of the Coringa Sector of the Mangrove Clear-felling Working Circle, except the closed coupes, will be open to seasonal grazing in the manner that has been described in Part II, Chapter II.

(2) Under the current scheme, 5,371 acres of 'inaccessible' forest in Sudikonda, Tirumalayapalem, and Mallavaram reserves are permanently closed to grazing. There is no necessity for such closure, and these areas have been thrown open to grazing, leaving inaccessibility to be determined by the graziers themselves.

Elsewhere there is a slight increase in the areas closed to grazing.

SECTION 2.—REGULATION AND CONTROL OF GRAZING.

421. *Conditions that influence regulation and control.*—In the Lower Godavari division, the regulation and control of grazing is influenced by the following factors :—

(1) The Agency tribes have the privilege of free grazing ; and for political reasons it is considered undesirable to restrict the privileges that these tribes enjoy.

(2) It is difficult to herd or round-up cattle in the mangrove swamps ; and it has long been the custom to turn cattle loose in these forests to graze unattended.

(3) There are a few small herds of unowned cattle—commonly referred to as 'wild cattle' in the Kandikuppa Casuarina Plantation and Coringa reserve. Apart from the damage done by these herds, they are a nuisance, because the protective staff commonly attribute all signs of grazing offences to 'wild cattle.'

(4) There is seasonal migration of cattle from the Delta to the Uplands and the Agency.

422. *Grazing fees.*—One of the purposes of levying grazing fees is to restrict the incidence of grazing ; and, theoretically, the greater the demand for grazing the higher should be the fees. Very cheap grazing leads to overgrazing, and in the long run it is more harmful than beneficial to the people. There is an extraordinary range of grazing fees in the Lower Godavari division, fixed at different times, and based on different principles. (See Part I, Chapter V.) The lowest rate is one anna per cow or buffalo per annum for settlers in the Yellavaram division of the Agency, and the highest is six annas per cow and twelve annas per buffalo per annum for the two Devancheruvu blocks and for migratory cattle. It is undesirable to abolish or curtail the privilege of free grazing enjoyed by the Koyas and Reddis of the Agency, but for all others a uniform rate should be charged throughout the division. It was proposed by the Chief Conservator, in his letter to Government No. 5518/32-Cl., dated 5th June 1933, that the grazing fees should be fixed at six annas per cow-unit for local grazing, and twelve annas per cow-unit for migratory cattle ; but in G.O. No. 1126, Development, dated 15th September 1933, it was decided that, owing to the agricultural depression, the question of revising the grazing fees should be deferred for the present ; and the Chief Conservator was requested to re-open the question at a suitable opportunity. It is hoped that a suitable opportunity will arise during the period of this working plan

423. *The grazing unit.*—In accordance with G.O. Ms. No. 802, Development, dated 11th June 1932, the grazing unit is a range, or the whole division, at the option of the graziers. The highest rate fixed for any range will be charged for permits covering the whole division. This order is tentative and the question will be re-examined at the end of 1934.

424. *Seasonal grazing in the Coringa Sector of the Mangrove Clear-felling Working Circle.*—The Coringa Sector of the Mangrove Clear-felling Working Circle will be open to grazing from July to December, when the demand is greatest ; and it will be closed to grazing for the remainder of the year, when the forests are most in need of protection. Details will be found in Part II, Chapter II.

425. *Herding cattle in the mangrove swamps of the Coringa reserves.*—Admittedly it is difficult to herd cattle in these swamps, particularly during the rains ; and if the cattle are not herded the protection of the closed coupes is difficult. As the felling series will be open to grazing for only six months in the year, herding will not be insisted on but it must be impressed on the cattle owners that if they graze their cattle unattended it is at their own risk, and all cattle found in closed coupes will be impounded.

Compartments 2 (*a*), 3 (*a*) and 3 (*b*) which are not included in the Mangrove Clear-felling Working Circle, are open to grazing throughout the year. Cattle grazing in these compartments from January to June must be accompanied by a grazier. No fresh water is available in the mangrove swamps in the dry weather, and it is customary for graziers to convey boat-loads of water to convenient places alongside the creeks, where wooden troughs are erected, and fresh water is stored in large pots. The cattle collect at these watering places, and the ground in the vicinity is grazed bare. It is necessary that these watering places should be as far as possible from the closed areas ; consequently watering will be permitted only at the places marked on the working plan maps.

426. *Herding cattle in the mangrove swamps of Upputeru reserve.*—The conditions in Upputeru reserve are somewhat different to those in the Coringa reserves. The large grassy blanks west of the Dongapandi have been thrown open to grazing without restriction, but all cattle grazing in the three felling series must be accompanied by graziers. (See Part II, Chapter III.)

427. *Rounding-up unowned cattle.*—It is believed that there is a fairly large number of ownerless buffaloes in the Coringa reserves. The District Forest Officer will investigate this. The best time to do so is in the hot weather when there is no water in the reserves, and the cattle collect at the watering places referred to in the previous paragraph. All unowned buffaloes must be rounded up and disposed of. There is a small herd of 'wild' cattle in the Kandikuppa Casuarina plantation. It will not be difficult to drive the cattle into a fenced enclosure at the narrow end of the plantation, where they can be secured and disposed of. This must be attempted.

428. *Demarcation of closed coupes.*—All coupes closed to grazing will be marked with the usual red closure boards.

429. *Removal of fodder grass.*—The free removal of fodder grass will be permitted and encouraged in all the reserved forests of the Uplands and the Agency.

430. *Closure of burnt areas.*—Whenever there is good reason to believe that a forest fire is caused by incendiarism, either with the mistaken purpose of improving the grazing, or for any other cause, it is desirable to close the burnt area to grazing for a suitable period. The basic reason for such closure is silvicultural, and the authority justifying it is G.O. Mis. No. 1816, Development, dated 25th October 1929. In order to defeat the purposes of incendiarism closure to grazing must be prompt. The procedure to ensure prompt closure is an administrative measure which can best be left to the District Forest Officer and the Conservator who should act in consultation with the Collector. Although the main purpose of such closure is the preservation of the forest, nevertheless it is hoped that, in arresting the objects of incendiarism, it will prove preventative. It is not intended to be punitive. The privileges of the Koyas and Reddis of the Agency will be safeguarded, but their destructive habits must be restrained, as much in their own interests as in the interests of the Forest department. In the case of delta cattle however, in accordance with Chief Conservator of Forests Order Mis. No. 295/33, dated 27th June 1933, two months notice must be given of the intention to close to grazing.

SECTION 3.—IMPROVEMENT OF GRAZING FACILITIES.

431. *Grazing and fodder grass.*—The greater part of the Lower Godavari division consists of stony hill slopes, tidal swamps, and broken ground where little can be done to improve the quality of the grazing. Attempts to improve the supply of fodder grass would have to be confined to the blanks and open scrub on the flat or gently sloping ground that skirts the hills, and in the plains reserves ; also in the blanks of the mangrove forests that are

above tidal influence. The African, Kikiyu grass—*Pennistatum claudistinum* would probably establish itself in the open scrub jungle of Polavaram, Peddapur and Gokavaram ranges; and Gariki gaddi—*Cynodon dactylon* which comes in naturally when the mangrove swamps rise above tidal influence could probably be extended by cultivation. However as very little is known about the cultivation of forest grasses, no definite prescription will be laid down in the working plan; but it is suggested that the District Forest Officer should carry out small scale experiments in consultation with the Agricultural Department to determine what can be done towards the improvement of grazing when conditions are favourable for carrying out such work.

432. *Watering facilities for cattle in the reserved forests.*—Graziers have been afforded all necessary facilities for watering their cattle within the reserved forests; and it is left to the District Forest Officer to carry out any improvements in the water-supply that may be found necessary during the period of this plan.

SECTION 4.—CONTROL.

433. The following control records will be maintained :—

(1) The Control Book, and
(2) the Grazing Map.

A sample form of the control book will be found in Appendix VIII.

The grazing map will be maintained separately for each range, on a scale of 1 inch to a mile. It will show—

(1) all areas permanently closed to grazing,
(2) all coupes closed to grazing under the prescriptions of this working plan, and
(3) all burnt areas closed for recuperation.

CHAPTER XII.—MISCELLANEOUS REGULATIONS, PRESCRIBED AND SUGGESTED.

SECTION 1.—FIRE PROTECTION.

434. *General protection discussed and prescribed.*—The causes of forest fires in the Lower Godavari division may be grouped under three main heads :—

(1) Accidental fires originating within the reserved forests. The most common causes of such fires are: the carrying of naked torches through the forest by Koyas in the hot weather, and cooking in the reserved forests during the fire season while hunting or collecting minor forest produce.

(2) *Incendiarism.* There is no evidence to show the extent to which the forests are deliberately burnt. Grazing and hunting are believed to be the chief reasons for incendiarism.

(3) *Invading fires.* Fires frequently enter the reserved forest from zemindari land and from areas burnt for podu cultivation in village enclosures within the reserved forests.

The prevention of accidental fires and incendiarism is an administrative matter which can best be left to the vigilance of the District Forest Officer. It is doubtful that it will be possible to enforce the prohibition of carrying naked torches through the forest in the fire season; and it is prescribed that the paths connecting the village enclosures in Papikonda and Kopalli reserves and Kovvada block I, as well as the principal paths used by the inhabitants of these enclosures in going to and from the Kannapuram shandy from which they frequently return late at night, be fire traced to a width of 15 feet on each side. The selection of these paths will be left to the discretion of the District Forest Officer, and a lump sum provision will be made in the financial forecast for this purpose. In order to protect the forests against invading fires, and to restrict the damage done by fires that originate within the reserved forests, it is necessary to prescribe some form of direct protection. Past experience in the Lower Godavari division has shown that the maintenance of fire patrols in the hot weather, and indirect protection by granting rewards to the Agency tribes, are of little use—See paragraphs 78 and 142—and that a system of fire lines, though an imperfect form of protection is the best that can be adopted. Fire protection is unnecessary in the Rajahmundry range. The Polavaram, Gokavaram and Peddapur ranges will be protected by means of permanent and temporary fire lines. Temporary fire line will be used for the protection of areas under regeneration. These areas have been referred to in the chapters dealing with each working circle. The following statement shows the permanent fire lines to be maintained in each range :—

A. Polavaram range.

Reserved Forest. (1)	Hyderabad Frontier line. (2)		Reserved forest boundary lines. (3)		Boundary lines of enclosures. (4)		Roads, paths and other permanent fire lines. (5)		Totals. (6)	
	MILES.	CHAINS.	MILES.	CHAINS.	MILES.	CHAINS.	MILES.	CHAINS.	MILES.	CHAINS.
1 Beddadanole	2	60	8	50	..	..	8	64	20	14
2 Marlagudem	..	..	..	..	..	..	..	..	..	..
3 Kopalli	..	..	12	35	..	..	3	27	15	62
4 Kovvada block I	..	..	7	8	..	..	1	31	8	39
5 Papikonda and Kovvada block II	4	48	20	28	12	65	1	16	38	77
Totals ..	**7**	**28**	**48**	**41**	**12**	**65**	**14**	**58**	**83**	**32**

B. Gokavaram range.

Reserved Forest. (1)	Reserved forest boundaries on district or divisional boundary. (2)		Reserved forest boundaries on Agency line. (3)		Reserved forest boundaries on zamindari borders. (4)		Roads, paths and other permanent fire lines. (5)		Totals. (6)	
	MILES.	CHAINS.	MILES.	CHAINS.					MILES.	CHAINS.
1 Sudikonda	..	..	5	32	..	..	..	..	5	32
2 Mallavaram	..	..	2	76	..	..	..	..	2	76
3 Virabhadrapuram	..	..	4	35	..	..	..	..	4	35
4 Lakkonda	3	64	..	..	..	..	..	..	3	64
5 Doramamidi	5	63	..	..	..	..	..	..	5	63
Totals ..	**9**	**47**	**12**	**63**	..	..	..	..	**22**	**30**

C. Peddapur range.

Reserved Forest. (1)	Reserved forest boundaries on district or divisional border. (2)		Reserved forest boundaries on Agency line. (3)		Reserved forest boundaries on zamindari border. (4)		Roads, paths and other permanent fire lines. (5)		Totals. (6)	
	MILES.	CHAINS.	MILES.	CHAINS.	MILES.	CHAINS.	MILES.	CHAINS.	MILES.	CHAINS.
1 Banadapalli	7	48	..	..	..	..	..	..	7	48
2 Rajavomangi	..	..	..	..	..	..	2	..	2	..
3 Lododdi	3	70	2	2	..	..	..	..	5	72
4 Vatangi	..	..	4	24	..	..	..	..	4	24
5 Sarlanka	5	60	2	23	..	..	..	..	8	3
6 Raghavapatnam	..	25	..	..	6	10	..	..	6	35
7 Peddagarangi Vuligogula ..	..	..	6	39	..	..	..	..	6	39
8 Anantaram	..	..	..	..	7	8	..	..	7	8
9 Lingamparti	..	..	15	32	..	..	..	..	15	32
10 Annavaram	..	..	3	..	..	..	..	..	3	..
11 Anantagiri	5	70	..	..	..	..	..	..	5	70
Totals ..	**23**	**33**	**33**	**40**	**13**	**18**	**2**	..	**72**	**11**

435. *Special protection.*—The areas regenerated under the prescriptions of this working plan will be specially protected in the manner prescribed in the following paragraphs :—

(*a*) The Timber Clear-felling Working Circle— Polavaram range	Paragraph 298.
(*b*) The Papikonda Experimental Working Circle— Polavaram range	Do. 326.
(*c*) The Upland Coppice Working Circle— Gokavaram range	Do. 347.
(*d*) The Teak Conversion Working Circle— Peddapur and Gokavaram ranges	Do. 379.

All the permanent fire lines have been marked on the working plan maps. The extent of clearing and burning will vary greatly : the classification and rates at present in force appear suitable and have been adopted in estimating the cost of fire-protection in the financial forecast.

SECTION 2.—ROADS AND OTHER EXPORT WORKS.

436. *General remarks.*—A list of all forest roads in the Lower Godavari division, showing cost of construction, and expenditure on maintenance during the past ten years, will be found in Appendix V (*a*). In the Rajahmundry and Gokavaram ranges communications are good and no new road will be necessary for the purposes of this working plan. In Peddapur range, it will be necessary to improve the forest road connecting the Banadapalli reserve with the main metalled road from the Vizagapatam border to Yelleswaram. Communications are poor in the Polavaram range, and a fairly heavy programme of road construction is necessary for the development of this range. The road work necessary in each range will be dealt with separately.

437. *Polavaram range.*—The following roads are necessary for the successful working of this plan:—

(*a*) For extraction of timber from the Papikonda Working Circle—

(1) An unmetalled cart road 8 miles in length from the Tena Konda saddle in the Papikonda reserve above Korratur, to the southern end of Kovvada block II, via Chilekalur and Kotrupalli enclosures. The alignment of this road has been marked on the working plan map. It will be constructed by the Forest Engineer, and is estimated to cost Rs. 5,700.

(2) Temporary feeder roads aggregating about 5 miles in length will be constructed to link the main cart road with the fellings. These roads are estimated to cost Rs. 500 a mile. The feeder roads for the first coupe will be constructed by the Forest Engineer, and thereafter they will be constructed by the divisional staff. It is estimated that they will cost about Rs. 500 a mile and the total cost will be Rs. 2,500.

(3) A skidway about 9,000 feet in length will be constructed from the end of the cart road at the Tena Konda saddle, down the slopes to Korratur. It will be constructed by the Forest Engineer and is estimated to cost about Rs. 5,600.

(*b*) For the extraction of produce from the Beddadanole felling series of the Timber Clear-felling Working Circle, and general improvement in communications :

(1) The Ravitugudem-Ankhanagudem forest road needs a small diversion to avoid broken ground, and general improvement, which is estimated to cost about Rs. 500.

(2) At present carting is difficult between Mulagalampalli and Jangareddigudem, particularly during the rains. The construction of a cart road joining these two villages would greatly facilitate the transport of produce from Beddadanole reserve and make the reserve more easy of access. This road, which will be about 8 miles in length cannot be constructed by the Forest Department —it would be too expensive ; but it is believed to be under consideration by the Public Works Department. The District Forest Officer should press for the construction of this road, and if necessary a suitable proportion of the cost might be borne by the Forest Department.

(*c*) For the extraction of produce from the Puliramudugudem felling series of the Timber Clear-felling Working Circle and the extraction of bamboos.

(1) The Puliramudugudem–Munjulur forest road will be improved at a cost of about Rs. 800.

(2) The cart-track from Kannapuram to Puliramudugudem will be improved. This is estimated to cost about Rs. 750.

438. *Gokavaram range.*—No new roads are necessary for the extraction of produce from coupes to be worked under the prescriptions of this plan. The existing roads will be maintained in good order.

439. *Peddapur range.*—The metalled road from Yelleswaram to the district border passing through Jaddangi, is the chief means of communication in the Peddapur range. There is an incomplete section on this road, about four miles in length, between Jaddangi and Tantikonda. This is nearing completion and when it is open to traffic it will greatly facilitate the transport of produce from the reserved forests at the northern end of the range, particularly during the rains. Throughout the period of this working plan fellings in the Northern felling series of the Teak Conversion Working Circle will be concentrated in Banadapalli reserve and it will be necessary to improve the forest road connecting this reserve with the main metalled road, and maintain it in good order. The cost of improvements is estimated at about Rs. 500. The Ramanayyapeta–Lododdi forest road is one of the main extraction routes for bamboos, and, throughout the period of this working plan, it will be necessary to maintain it in a condition suitable for heavy cart traffic.

SECTION 3.—IMPROVEMENT OF WATERWAYS AND WATER-SUPPLY.

440. *Waterways in Coringa and Coringa Extension reserves.*—Some of the main creeks in Coringa reserve are silting up, and in the course of a few years they will be impassable at low tide for boats that draw more than a foot of water. The maintenance of these waterways is a big problem, and more expensive than can be undertaken by the Forest department. Some of these creeks are used largely by fishermen ; and it is as much in their interests as in the interests of the Forest department that they should be open to boats at all times. It may be possible, with the co-operation of the Labour department and the assistance of the fishermen, to dredge some of the silt bars in the narrow creeks, at low tide. For example, the Nagadaruva, which is the main approach by launch from Coringa bridge to Hope Island, is silting up and forming a bar at its junction with the Palamondi, and at low tide there is barely 18 inches of water at the bar. Other creeks

which need attention are parts of the Jadda kalva and the Sarrata kalva. The District Forest Officer will investigate the possibility of keeping these creeks open. A provisional allotment for this purpose will be made in the financial forecast.

441. *Wells.*—Wells are necessary for the Forest rest-house at Puliramudugudem, the Ranger's inspection shed at Bothappagudem, and for the Agency bungalow at Ankhanagudem. The wells at Puliramudugudem and Bothappagudem will cost about Rs. 200 each. The only water-supply at Ankhanagudem is from a village tank which is used for washing clothes and other insanitary purposes. As the bungalow is used chiefly by officers of the Forest department the District Forest Officer should press for the construction of a well.

SECTION 4.—BUILDINGS.

442. *New buildings.*—The new buildings that are necessary for the execution and supervision of works to be carried out under the prescriptions of this working plan are as follows :—

(1) *For the Papikonda Experimental Working Circle.*—Quarters for two foresters, quarters for two forest guards, and coolie lines.

(2) *For the Teak Conversion Working Circle.*—An inspection hut, with a kitchen and one room for servants, and quarters for a forest guard at Banadapalli.

(3) *For the Mangrove Clear-felling Working Circle.*—A boat house at Coringa bridge.

(4) *For the Mangrove Coppice Working Circle.*—Quarters for one forester at a suitable place adjoining Upputeru reserve.

(5) *For the Upland Coppice Working Circle.*—Construction of a Ranger's inspection hut and forester's quarters at Sudikonda.

(6) *For the Teak Clear-felling Working Circle.*—Construction of subordinates' quarters at Ankhanagudem and Puliramudugudem.

For general purposes the following new buildings are necessary :—Quarters for the Range Officer, Peddapur range ; a rest-house at Sivagiri to replace the Korratur rest-house which will be written off ; and a rest house near Mallavaram to replace the present rest-house which will be sold or otherwise disposed of.

443. *Capital improvements.*—Considerable improvements are necessary in the forest buildings of the Lower Godavari division. The major works are as follows :—

(1) Installation of electric lights and fans in the District Forest Officer's bungalow at Cocanada. The building is one of the postwar 'economy bungalows' with a low roof and very small rooms. The design is most unsuitable for the Cocanada climate, and electric fans and lights are necessary.

(2) Construction of a fence around the compound of the District Forest Officer's bungalow.

(3) Construction of a pakka roof for the Ravigudem rest-house. This building has stone walls in lime mortar and a light thatched roof. The local Koyas are very poor at thatching and the site is windy, consequently, the roof leaks badly. Galvanized corrugated iron laid on 1″ boards will probably prove most suitable.

(4) Construction of a pakka kitchen with one servant's room for the rest houses at Puliramudugudem and Ravigudem. At present the kitchen and servants' quarters are built of bamboo and mud with mud floors. They are dark and damp and most unsuitable for such unhealthy localities.

444. Other suggested improvements are as follows :—

(1) *Rajahmundry range.*—Construction of a kitchen, and other improvements to the Ranger's Inspection hut at Kandikuppa, addition of one room to the Range Office at Rajahmundry.

(2) *Peddapur range.*—Improvements to the inspection huts at Jaddangi and Annavaram.

(3) *Gokavaram range.*—Construction of a wall around range quarters at Gokavaram.

(4) *Polavaram range.*—Construction of a kitchen for the ranger's quarters at Jangareddigudem. Improvements to the forest guard's quarters at Jangareddigudem. Improvements to the Range Office at Jangareddigudem—the windows will be enlarged to let in more light.

445. *Building programme.*—The quarters and coolie lines for the Papikonda Experimental Working Circle will be constructed by the Forest Engineer, and are expected to be completed by the 31st March 1936. The order of executing the other works will be left

to the discretion of the District Forest Officer: it is desirable that the work should be carried out as expeditiously as funds will permit. The total capital expenditure on buildings to be incurred during the 10-year period of this working plan is roughly estimated at about Rs. 15,000.

SECTION 5.—LAUNCHES AND BOATS.

446. *Launches.*—The launch and motor boat now in stock are not altogether suitable for the Lower Godavari division. The steam launch 'Thistle' is used chiefly for towing the house boat 'Irene' up the Godavari, and down to Coringa and Kandikuppa. For inspection purposes it is slow and expensive, and has too deep a draught for use in the creeks of the mangrove swamps. The out-board motor boat 'Avicennia' has been laid up for over two years with ignition trouble. Besides being expensive to run, out-board motor engines need great care and attention. For inspecting the mangrove swamps, and for general use in the Lower Godavari division, a motor boat to be efficient should have a low draught, a speed of 10 to 12 knots, and an economical, more or less fool-proof engine. A compression ignition engine of the Diesel type burning crude oil will probably prove most efficient. These engines are somewhat heavy but the ignition is fool-proof, and the running expenses are very low. Engines of this type are commonly used for rice mills and water pumps in the Godavari district; and Diesel engine oil can be obtained in bulk at Cocanada. It is suggested that a light launch fitted with a suitable type of Diesel engine, should be built at Dowlaishwaram or Rajahmundry to the specifications of the Forest Engineer as soon as funds are available. This can best be done while the Forest Engineer is employed in the Lower Godavari division on the construction of the slide and road in Papikonda reserve.

447. *Boats.*—For the efficient protection of the mangrove forests each beat should be provided with a light boat of the type called 'Nava' in the Godavari district. These boats, complete with oars and sails, can be built at Talarevu near Coringa for Rs. 80. Six boats will be purchased four for the beats of Coringa and Coringa Extension reserves, and two for the Upputeru reserve. When funds permit it is desirable that the Range Officer, Rajahmundry range, should be provided with a cheap form of house boat, known locally as a rhadari boat, to enable him to camp at Hope Island and the more remote parts of Coringa Extension reserve which cannot be inspected satisfactorily from Coringa. A boat of this type will cost about Rs. 750.

SECTION 6.—GAME PRESERVATION.

448. There is very little wild life in the forests of the Lower Godavari division—far less than one would expect. The probable causes of this have been mentioned in paragraph 74 of this working plan. In order to tighten up the protection of game the following rules are prescribed:—

(1) It must be impressed on the protective staff that the preservation of wild life is an important part of their duties.

(2) All salt licks and water holes in each beat will be located and marked on the maps, and they will be patrolled regularly, particularly in the hot weather.

(3) A list will be maintained in each range office of all persons resident within 5 miles of a reserved forest who possess gun licenses, excluding the towns of Cocanada and Rajahmundry.

These rules will prove ineffective unless the Range Officers take a personal interest in the preservation of wild life.

CHAPTER XIII.—STAFF AND LABOUR.

SECTION 1.—STAFF.

449. No additional staff is necessary for the purposes of this working plan, nor will it be possible to make any immediate reduction in the staff. The redistribution that is necessary to carry out the prescriptions of this plan will be left to the discretion of the District Forest Officer.

SECTION 2—LABOUR.

450. Labour is sufficient for all purposes except for the work to be carried out in the Papikonda Experimental Working Circle, and for the extraction of bamboos in parts of Polavaram range. It will be necessary to recruit a small labour force for work in the Papikonda Experimental Working Circle.

CHAPTER XIV.—FINANCIAL FORECAST AND COST OF THE WORKING PLAN.

SECTION I.—FORECAST OF REVENUE AND EXPENDITURE.

451. An approximate forecast of the revenue and expenditure that will be derived from and incurred in each working circle during the ten years—1934–1944—is given in the following statement :—

Revenue.		*Expenditure.*	
Particulars. (1)	Amount. (2) RS. A.	Particulars. (3)	Amount. (4) RS. A.

I. THE MANGROVE CLEAR-FELLING WORKING CIRCLE.

1 From the sale of coupes I to X of Coringa, Hope Island, and Bhyravapalem Felling Series :— 8,206 acres, wooded at Rs. 30 per acre—Paragraph 200 ..	2,46,180 0	1 On surveying and cutting the boundary lines of 50 coupes in 10 years, at Rs. 10 per coupe—Paragraph 205	500 0
2 From the sale of coupes I to X of the Pandipalem and Pora Felling Series of Kandikuppa reserve :— 2,105 acres, wooded at Rs. 10 per acre—Paragraph 200 ..	21,050 0	2 On erecting 140 coupe stones in 10 years at Rs. 4 per stone—Paragraph 205	560 0
3 From the sale of dry fuel licenses in Coringa and Coringa Extension reserves for 10 years at Rs. 250 per annum—Paragraph 209	2,500 0	3 Lump sum allotment for the maintenance of water-ways—Paragraph 439	2,500 0
		4 Other works at Rs. 100 per annum for 10 years	1,000 0
		5 Cost of 4 beat patrol boats—*Navas*—at Rs. 80 each—Paragraph 447 ..	320 0
Total, Revenue ..	**2,69,730 0**	Total, Expenditure ..	**4,880 0**

Explanatory remarks.—(1) The estimated rate of Rs. 30 per acre for the coupes of the Coringa, Hope Island, and Bhyravapalem Felling Series relates to wooded areas only. The rates per acre paid in past years cover large blanks, while extensive areas were left unfelled. A more correct comparison can be made with the total revenue received annually from the coupes of Coringa and Coringa Extension reserves.

(2) The estimated rate of Rs. 10 per acre wooded, is somewhat low for the Pandipalem and Pora Felling Series. These coupes will be worked solely for the fisher-folk, and represents what they may be expected to pay.

II. THE MANGROVE COPPICE WORKING CIRCLE.

1 From the sale of coupes I to X of the Dongapandi, Losari, and Kottapusalamuri Felling Series :— 1,756 acres wooded at Rs. 7 per acre—Paragraph 228 ..	12,292 0	1 On surveying and demarcating 30 coupes in 10 years at Rs. 5 per coupe—Paragraph 231	150 0
		2 On erecting 80 coupe stones at Rs. 4 per stone—Paragraph 231 ..	320 0
2 From fishing fees for 10 years at Rs. 300 a year—Paragraph 233 ..	3,000 0	3 Experimental sowings and other unforseen works—Paragraph 230.	250 0
Total, Revenue ..	**15,292 0**	Total, Expenditure ..	**720 0**

Explanatory remarks.—(1) The rate of Rs. 7 per acre, wooded, has been determined from an average rate of Rs. 3–12–0 per acre for coupes including blanks which occupied more than a half of each coupe.

(2) The estimated revenue from fishing fees is a rough approximation.

III. CASUARINA PLANTATION WORKING CIRCLE.

1 From the sale of faggot wood from pruning 750 acres at Rs. 2–12–0 per acre—Paragraphs 258 and 270 ..	2,062 8	1 On cost of pruning 750 acres at Re. 1 per acre	750 0
2 From the sale of stem wood from thinning 750 acres at Rs. 20 per acre—Paragraphs 259 and 270 ..	15,000 0	2 On cost of thinning 750 acres yielding 10 cubic yards per acre at 6 annas per cubic yard	2,812 4
3 From the sale of branch wood from thinning 750 acres at Rs. 2 per acre—Paragraphs 259 and 278 ..	1,500 0	3 On cost of felling and stacking the stem wood from 700 acres of the final crop, yielding 23 tons per acre, at Rs. 1–2–0 a ton of 3 cubic yards	18,112 8
4 From the sale of stem wood from final felling 700 acres at Rs. 138 per acre—Paragraphs 250 and 270 ..	96,600 0	4 Cost of extracting stumps on 700 acres at Rs. 10 per acre	7,000 0
From the sale of branch wood from final felling :— 700 acres at Rs. 6 per acre—Paragraphs 250 and 270 ..	4,200 0 0	5 On cost of planting 780 acres with Casuarina at Rs. 25 per acre all in.	19,500 0
6 From the sale of stumps on 700 acres at Rs. 15 per acre	10,500 0	6 On cost of planting 50 acres with *Eucalyptus rostrata* at Rs. 25 per acre	1,250 0
		7 Planting palmyras erecting coupe boards, purchasing new wire for fencing and other unforseen expenses at Rs. 400 per annum ..	4,000 0
Total, Revenue ..	**1,29,862 8**	Total, Expenditure ..	**53,424 12**

Explanatary remarks.—The rates are based on the actuals for the past few years.

IV. TIMBER CLEAR-FELLING WORKING CIRCLE.

Revenue.			*Expenditure.*		
Particulars. (1)	Amount. (2)		Particulars. (3)	Amount. (4)	
	RS.	A.		RS.	A.
1 From the sale of 579 acres in coupes I to X of the Beddadanole and Puliramudugudem Felling Series at Rs. 30 per acre—Paragraph 284.	17,370	0	1 Local data is not available to show the cost of regenerating the felled coupes on the Walayar System and subsequent tending. The total cost including demarcation is roughly estimated at Rs. 25 per acre—Paragraphs 285 to 293 ..	14,500	0
			2 Other works—Paragraphs 293 to 295—at Rs. 50 a year	500	0
Total, Revenue ..	**17,370**	**0**	Total, Expenditure ..	**15,000**	**0**

Explanatory remarks.—(1) The price per acre received during the past 10 years ranges from Rs. 19 to Rs. 44, averaging Rs. 24. As the coupes to be worked under this plan have been specially selected, contain a high percentage of teak and are easily accessible, an average rate of Rs. 30 per acre is considered reasonable.

V. THE PAPIKONDA EXPERIMENTAL WORKING CIRCLE.

1 From the sale of 80,000 cubic feet of teak in 8 years (operations will start in 1936–37), from Coupes I to VIII, at Re. 1 per cubic foot delivered on the river bank at Korratur—Paragraphs 316 and 317 ..	80,000	0	1 On felling 140,000 cubic feet of timber at 6 pies per cubic foot ..	4,375	0
2 From the sale of 60,000 cubic feet of rosewood, *Terminalia tomentosa*, *Pterocarpus marsupium* and other species, from coupes I to VIII and compartments 7 and 8, at an average price of 10 annas a cubic foot delivered on the river bank at Korratur—Paragraphs 316 and 317.	37,500	0	2 On dragging 140,000 cubic feet of timber from the stump sites to the cart road, at 2 annas a cubic foot	17,500	0
			3 On carting 140,000 cubic feet from the stump sites to the cart road at 2 annas a cubic foot	17,500	0
			4 On working 140,000 cubic feet down the skidway to the river bank at 2 annas a cubic foot ..	17,500	0
			5 Cost of constructing the skidway as estimated by the Forest Engineer	5,600	0
			6 Cost of maintaining the skidway for 8 years at Rs. 500 a year, as estimated by the Forest Engineer	4,000	0
			7 Interest at 5·52 per cent per annum for 8 years on Rs. 2,850—half the cost of the main road as estimated by the Forest Engineer. The construction will be progressive for 8 years	1,260	0
			8 Cost of maintaining an average length of 4 miles of the main road for 8 years at Rs. 100 per mile a year	3,200	0
			9 Cost of feeder roads as estimated by the Forest Engineer	2,500	0
			10 Cost of planting 240 acres with teak and tending the plantations, at a mean cost of Rs. 35 per acre all in	8,400	0
			11 Climber cutting in timber compartments and other operations—lump sum	1,000	0
Total, Revenue ..	**1,17,500**	**0**	Total, Expenditure ..	**82,835**	**0**

Explanatory remarks.—(1) The estimates are based mainly on the Forest Engineer's Part II Scheme for working the Papikonda Experimental Working Circle, with the additional provision for the extraction of saleable timber of miscellaneous species, and a slight redistribution of the capital costs.

(2) The cost of regenerating the clear-felled areas is only a rough approximation.

Revenue. *Expenditure.*

VI. THE UPLAND COPPICE WORKING CIRCLE.

Particulars. (1)	Amount. (2) RS. A.	Particulars. (3)	Amount. (4) RS. A.
1 From the sale of 1,570 acres in coupes I to X of the Sudikonda, Tirumalayapalem North, and Tirumalayapalem South Felling Series at an average price of Rs. 30 per acre—Paragraph 343	47,100 0	1 On surveying and demarcating 60 coupes in 10 years at Rs. 10 per coupe—Paragraph 346	600 0
2 From the sale of 512 acres in Mallavaram Felling Series at Rs. 25 per acre—Paragraph 343	12,800 0	2 On erecting 180 coupe stones at Rs. 3 per stone—Paragraph 346.	540 0
3 From the sale of 816 acres in coupes I to X of the Devancheruvu East and West Felling Series at Rs. 50 per acre—Paragraph 343	40,800 0	3 On rab sowings over 300 acres at about 30 acres a year, all operations including tending as prescribed at Rs. 2 per acre—Paragraph 344	600 0
		4 Climber cutting the year after felling over 2,602 acres at 8 annas an acre—Paragraph 345	1,301 0
		5 Tending in the sixth year over 1,155 acres at Rs. 1-8-0 an acre—Paragraph 345	1,732 0
Total, Revenue ..	**1,00,700 0**	Total, Expenditure ..	**4,773 0**

Explanatory remarks.—(1) The average price obtained during the past 10 years for the coupes in the Sudikonda and Tirumalayapalem Felling Series was Rs. 22 per acre, and Rs. 18 per acre in the Mallavarm Felling Series. Some of the old coupes contained large patches of bamboo and parts were inaccessible and remained unworked. All areas containing dense bamboo and all areas that are not easily accessible have been excluded. This has reduced the area to be worked, but it is estimated that the value of the coupes is increased by about Rs. 7 to 8 per acre. Consequently the average price for the coupes in the Sudikonda and Tirumalayapalem Felling Series is estimated at Rs. 30 per acre, and the Mallavaram Coupes at Rs. 25 per acre.

(2) The figures for the Devancheruvu coupes are based on past averages.

VII. THE TEAK CONVERSION WORKING CIRCLE.

Particulars. (1)	Amount. (2) RS. A.	Particulars. (3)	Amount. (4) RS. A.
From the sale of 218 acres in coupes I to X of the Northern and Southern Felling Series of the Teak Conversion Working Circle at Rs. 35 per acre—Paragraph 365 ..	7,630 0	1 On planting and tending 218 acres in coupes I to X of the Northern and Southern Felling Series of the Teak Conversion Working Circle at Rs. 35 per acre—Paragraphs 366 to 377	7,630 0
Total, Revenue ..	**7,630 0**	Total, Expenditure ..	**7,630 0**

Explanatory remarks.—The estimates are approximate only. It is estimated that the revenue will just cover the expenditure.

VIII. THE BAMBOO WORKING CIRCLE.

Particulars. (1)	Amount. (2) RS. A.	Particulars. (3)	Amount. (4) RS. A.
1 From the sale of 16 coupes per annum for 10 years at an average price of Rs. 30,000 per annum ..	3,00,000 0	Nil.	
Total, Revenue ..	**3,00,000 0**		

Explanatory remarks.—The average revenue for the 5 years ending March 1933 amounts to Rs. 28,419. The improvement of roads, and increased facilities for the extraction of bamboos in the Papikonda Reserve and Kovvada block II, as well as a reduction in the size of the coupes, will probably result in a rise in the revenue. In round figures, the revenue is estimated at Rs. 30,000 per annum for the period of this plan.

IX. THE MINOR PRODUCTS WORKING CIRCLE.

Particulars. (1)	Amount. (2) RS. A.	Particulars. (3)	Amount. (4) RS. A.
1 From the sale of minor produce throughout the division at an average of Rs. 7,000 per annum ..	70,000 0	Nil.	
Total Revenue ..	**70,000 0**		

Explanatory remarks.—The estimated revenue is based on the average for the past three years.

X. THE GRAZING WORKING CIRCLE.

Particulars. (1)	Amount. (2) RS. A.	Particulars. (3)	Amount. (4) RS. A.
1 From the collection of grazing fees, estimated on the average of the past three years at Rs. 11,500 per annum—Paragraph 422	1,15,000 0	1 On experiments with grasses—Paragraph 433	250 0
Total, Revenue ..	**1,15,000 0**	Total, Expenditure ..	**250 0**

452. *Revenue from other sources.*—The following statement shows the estimated revenue from other sources, for the period 1934–44 :—

Item number. (1)	Particulars. (2)	Amount. (3) RS.	Remarks. (4)
	VIII. Forests.		
	(b) Revenue from forest produce collected by the Revenue Department—		These figures are based on the average for the three years ending 31st March 1933.
1	Timber	53,300	
2	Firewood and charcoal	12,800	
3	Other minor produce	2,07,900	
4	(c) Drift and waifwood and confiscated forest produce	26,100	
	(d) Miscellaneous—		
5	Fines and forfeitures	26,400	
6	Rents of buildings	17,000	
7	Other sources	83,700	Based on average for the 5 years ending 31st March 1933.
	Total ..	4,27,200	

453. *Expenditure on Conservancy and Works.*—The following statement is the estimated expenditure on works, other than those that relate specifically to the several working circles, for the period 1934–44 :—

Item number. (1)	Particulars. (2)	Amount. (3) RS.	Remarks. (4)
	8.-b. Conservancy and works.		
1	C-2—Renewals and replacement of stores, tools and plant, at an average of Rs. 4,500 per annum.	45,000	This is based on averages for the three years ending 31st March 1933.
	D-1—Roads and buildings.—		
2	It is estimated that the following expenditure on new roads will be incurred during the period of this working plan—		
	RS.		
	(a) For works detailed in paragraph 436. 2,550		
	(b) Other roads to be constructed at the discretion of the District Forest Officer. 5,450		
	Total .. **8,000**		
	The expenditure will be distributed over 10 years. Interest at 5 per cent per annum on half of the expenditure on new roads, for 10 years.	2,000	
3	Maintenance of old and new roads based on actuals for the past three years for old roads + 5 per cent of the capital cost of new roads.	18,000	
4	D-2. Buildings— The anticipated capital expenditure on new buildings during the ten years—covered by this working plan is Rs. 15,000 Paragraph 445. The work will be distributed over 10 years. Interest at 5 per cent on Rs. 7,500 for 10 years.	3,750	
5	Maintenance of new and old buildings at 2 per cent on capital cost of Rs. 85,000.	17,000	
6	Other works at Rs. 50 per annum	500	Based on averages.
	E-b. Fire protection.		
7	Cost of maintaining 180 miles of permanent fire lines at an average cost of Rs. 4 per mile—Paragraph 433.	7,200	
8	Cost of maintaining 100 miles of temporary fire lines at Rs. 3 per mile—Paragraph 434.	3,000	
9	Other fire protection works at the discretion of the District Forest Officer—Paragraph 434.	2,000	
10	E.C. Other charges—Lump sum	5,000	
11	F. Other charges—Non-voted, includes rates and taxes, drift and waifwood, miscellaneous at Rs. 4,660 per annum.	46,600	Based on the averages of the past three years.
	Total Expenditure ..	1,50,050	

454. *Establishments.*—The following statement shows the estimated expenditure on 8. c. Establishments for the period 1934–44 :—

Item number. (1)	Particulars. (2)	Amount. (3) RS.	Remarks. (4)
	8-c. *Establishments.*		
1	*Controlling staff.*—Non-voted—District Forest Officer. A Deputy Conservator of Forests on an average salary of Rs. 997 per mensem.	1,19,640	(1) A gazetted assistant is necessary as long as the Rampa Agency and the River range form part of the Lower Godavari division. His pay is a charge against the Rampa revenues not included in this plan. (2) The establishment employed in the River range; which is ancillary to the Rampa Agency is not included in this statement.
2	*Executive staff.*—Voted—Four rangers, one each for the Rajahmundry, Polavaram, Peddapur and Gokavaram ranges, on an average salary of Rs. 138 per mensem.	66,240	
3	Twelve foresters, three each for the four ranges, on an average salary of Rs. 37 per mensem.	53,280	
4	Forty-eight forest guards—one each for 48 beats, at an average salary of Rs. 17 per mensem.	97,920	
	Office Establishment.		
5	District Forest Office establishment comprising— Head clerk .. .. 1 Accountant .. .. 1 Second clerk .. .. 1 Third clerk .. .. 1 Fourth clerk .. .. 1 Fifth clerk .. .. 1 Draftsman .. .. 1 Typist .. .. 1 Peons .. .. 4 at an average monthly cost of Rs. 480	57,600	
	Range Office Establishments.		
6	Four Range clerks on an average salary of Rs. 45 per mensem.	21,600	
7	Four Range peons on an average salary of Rs. 14 per mensem.	6,720	
	Temporary Establishments.		
8	Forty-eight Forest Reserve watchers, one for each beat at Rs. 8 per mensem.	46,080	
9	Two office watchers, one on Rs. 12 and the other on Rs. 11 per mensem.	2,760	
10	Two bungalow watchers at Rs. 8 per mensem ..	1,920	
11	Two sweepers at Rs. 3–8–0 per mensem	840	
12	Four range peons at Rs. 12 per mensem	5,760	
13	Five gumastahs on an average salary of Rs. 30 per mensem.	18,000	
14	Eleven tanadars on an average salary of Rs. 10 per mensem.	13,200	
15	Staff of the steam launch Thistle— Driver 1—Pay Rs. 30 per mensem. Serang 1—Pay Rs. 27 per mensem. Fireman 1—Pay Rs. 14–8–0 per mensem. Lascar 1—Pay Rs. 13–8–0 per mensem. Lascars two on Rs. 12—Rs. 24.		
	Total 109 per mensem.	**13,080**	
16	The motor boat ' Avicennia '— Driver 1—at Rs. 18 per mensem	2,160	
17	The staff boat ' Irene '— Serang 1—at Rs. 12 per mensem	1,440	
18	Other boats—One serang on Rs. 12 per mensem ..	1,440	
19	Travelling allowances—Non-voted—Averaging Rs. 2,000 per annum.	20,000	A proportionate deduction has been made for the staff employed in the Rampa Agency.
20	Travelling allowances—Voted—Averaging Rs. 3,800 per annum.	38,000	
21	Fixed travelling allowances, averaging Rs. 2,000 per annum.	20,000	
22	Other compensatory allowances, averaging Rs. 500 per annum.	5,000	
23	Contingencies, supplies and services at Rs. 3,800 per annum.	38,000	
	Total Expenditure ..	**6,50,680**	

455. *Direction expenses.*—The proportionate share of the establishment of the Conservator, Waltair Circle, Chargeable to the Lower Godavari division, is estimated at Rupees 8,000 per annum or Rs. 80,000 for the whole period of this working plan.

ABSTRACT OF ESTIMATED REVENUE AND EXPENDITURE FOR 1933–34.

Item number.	Particulars.	Amount.	Item number.	Particulars.	Amount.
		RS.			RS.
	Revenue.			*Expenditure.*	
	From—			On—	
1	The Mangrove Clear-felling Working Circle.	2,69,700	1	The Mangrove Clear-felling Working Circle.	4,900
2	The Mangrove Coppice Working Circle.	15,300	2	The Mangrove Coppice Working Circle.	700
3	The Casuarina Plantation Working Circle.	1,29,900	3	The Casuarina Plantation Working Circle.	53,400
4	The Timber Clear-felling Working Circle.	17,400	4	The Timber Clear-felling Working Circle.	15,000
5	The Papikonda Experimental Working Circle.	1,17,500	5	The Papikonda Experimental Working Circle.	82,800
6	The Upland Coppice Working Circle.	1,00,700	6	The Upland Coppice Working Circle.	4,700
7	The Teak Conversion Working Circle.	7,600	7	The Teak Conversion Working Circle.	7,600
8	The Bamboo Working Circle.	3,00,000	8	The Grazing Working Circle.	300
9	The Minor Products Working Circle.	70,000	9	Other items of Conservancy and Works.	1,50,100
10	The Grazing Working Circle.	1,15,000	10	Establishment	6,50,700
11	Revenue from other sources.	4,27,200	11	Direction	80,000
				Total expenditure for 10 years.	**10,50,200**
				Add Surplus for the 10 years ..	5,20,100
	Total revenue for 10 years ..	**15,70,300**		Grand total ..	**15,70,300**

NOTE.—(1) The average annual revenue is expected to be Rs. 1,57,030.
(2) The average annual expenditure is expected to be Rs. 1,05,020.
(3) The average annual surplus is expected to be Rs. 52,010.
(4) The gross revenue per acre per annum—8·5 annas.
(5) The management costs per acre per annum—5·7 annas.
(6) The surplus costs per acre per annum—2·8 annas.
(7) The percentage of expenditure to gross revenue—68 per cent.
(8) The average surplus for the three years ending March 1933, was Rs. 29,000.

SECTION 2.—COST OF THE WORKING PLAN.

456. The following statement shows the cost of the working plan :—

Item number. (1)	Particulars. (2)	Amount. (3)	Remarks. (4)
		RS. A.	
	52-*A. Working Plans.*		
1	Expenditure on enumerations, surveys and other works, including expenditure incurred in the working plans circle towards printing 17 sets of working plan maps.	2,314 15	The following charges are not included :— (1) Pay and travelling allowances drawn by the Working Plans Officer when on settlement duty in the Rampa Agency. (2) Leave salaries.
	Establishment charges.		
1	Pay of officers—Non-voted	23,481 13	
2	Pay of officers—Voted	6,891 14	
3	Pay of permanent establishment	20,328 1	
4	Pay of temporary establishment	791 2	
5	Travelling allowance—Non-voted	4,473 6	
6	Travelling allowance—Voted	7,478 2	
7	Fixed travelling allowances	1,538 4	
8	Other compensatory allowances	703 15	
9	Contingencies	1,779 13	
	Total Expenditure ..	**69,781 5**	

R. B. CORNWELL,
Working Plans Officer,
No. 1 (*Working Plans*) *division,*
Lower Godavari.

C. C. WILSON,
Conservator of Forests,
Working Plans Circle,
Ootacamund.

SUMMARY OF PRESCRIPTIONS.

INTRODUCTORY.

	PARA.	PAGE.
The Tract dealt with.—This working plan is for the reserved forests of the Lower Godavari division excluding the Rampa Agency where forest reservation is not yet complete and forest organization has not advanced far enough for the reserves to be brought under a regular working plan	..	1

I. BASIS OF PROPOSALS.

	ACRES.	PARA.	PAGE.
General objects of management.—The general objects of management are :— (1) To provide for the exercise of all privileges to grazing and forest produce. (2) To meet the demand for timber, fuel, bamboos and minor forest produce. (3) To increase the value of the forest by introducing teak wherever it is likely to grow well. (4) To conserve, as efficiently as possible, the large areas that cannot be worked profitably at the present time		163	48
Method of treatment.—(1) The mangrove forests in which the Avicennias predominate will be clear-felled and regenerated naturally by seed		166	48
(2) The mangrove forests in which species that coppice predominate will be treated as simple coppice		166	48
(3) The Casuarina plantations will be clear-felled and planted		167	48
(4) The teak forests of Polavaram range will be worked partly on the Walayar method, and partly on a composite method of treatment suitable to the prevailing conditions		168	48–49
(5) All areas in the mixed deciduous forests where there is a demand for fuel will be worked as simple coppice		169	49
(6) All areas suitable for growing teak in Peddapur and Gokavaram ranges will be clear-felled and planted with teak		170	49
(7) The bamboo forests will be worked on a system of partial clear-felling		171	49
Working Circles.—The forests have been divided into ten working circles :—			
1 Mangrove Clear-felling	27,136	173	49
2 Mangrove Coppice	6,126	174	49
3 Casuarina Plantation	937	175	49
4 Timber Clear-felling	2,893	176	49
5 Papikonda Experimental	3,703	177	49
6 Upland Coppice	7,787	178	50
7 Teak Conversion	1,170	179	50
8 Bamboo	190,180	180	50
9 Minor Products	296,547	181	50
10 Grazing	277,325	182	50
A tabular statement shows the distribution of the working circles among the four ranges		183	50
Period of the working plan.—The working plan will be in force for ten years, from the 1st April 1934 to the 31st March 1944		184	50

II. THE MANGROVE CLEAR-FELLING WORKING CIRCLE.

	PARA.	PAGE.
Constitution of the working circle.—The working circle covers all the mangrove forests in which the Avicennias are the principal species. It covers the greater part of Coringa, Coringa Extension, and Kandikuppa reserves	185	51
Areas excluded from the working circle.—The compartments and sub-compartments of Coringa, Coringa Extension and Kandikuppa reserves that are excluded from the working circle are mentioned, and reasons are given for the exclusion	186	51
Division into blocks.—The Coringa and Coringa Extension reserves have been divided into three blocks :—Coringa North block, Coringa East block, and Coringa West block. The Kandikuppa reserve forms one block	188	51

PARA. PAGE.

Subdivision into compartments, and sub-compartments.—The Coringa North block is under water and forms one compartment. Coringa East block has been divided into fifteen compartments, and Coringa West block into nine compartments. In ali, there are 25 compartments in Coringa and Coringa Extension reserves. The Kandikuppa reserve has been divided into 13 compartments. A detailed statement shows the distribution and area of all the compartments and sub-compartments included in the working circle 189 51

Subdivision of the working circles into sectors.—The necessity for subdivision is discussed. The working circle has been divided into two sectors: The Coringa Sector and the Kandikuppa Sector. A sector is defined as part of a working circle in which the rotation has been altered, or the silvicultural system modified, to meet the special objects of management 190 52

Felling series and reasons for their formation.—The Coringa Sector has been divided into three felling series :— 191 53

	ACRES.
(1) The Coringa Felling Series	8,889·2
(2) The Hope Island Felling Series	6,197·2
(3) The Bhyravapalem Felling Series	8,139·4
Total area ..	**23,225·8**

53

The Kandikuppa Sector has been divided into two felling series :—

	ACRES.
(1) The Pandipalem Felling Series	3,271
(2) The Pora felling series :	640
Total area ..	**3,911**

53

Analysis of the crop.—The analysis carried out for the purpose of this working plan is described 192 53

Valuation of the crop.—For want of reliable data it is not possible to make an accurate valuation of the growing stock 193 53

Silviculture of the principal species.—The silvicultural requirements of the principal species are summarised 194 53–54

The silvicultural system.—The silvicultural system is clear-felling with natural regeneration 195 54

Rotation.—In the Coringa Sector, the rotation is 25 years, and in the Kandikuppa Sector it is 15 years. Reasons are given for adopting these rotations 196 54

Regulation of the yield.—The yield has been prescribed and regulated by area. The economic yield and its influence on the management of these forests, is discussed 197 54

Felling rules for the Coringa Sector.—There are seven felling rules for the Coringa Sector: one relates to the period of lease, four prescribe the manner of executing the fellings, a sixth rule prescribes the removal of slash from the creeks within the coupes, in order to allow free movement of floating seed, and the last rule relates to the collection of figures of yield .. .. 198 54 -55

Felling rules for the Kandikuppa Sector.—There are six felling rules for the Kandikuppa Sector which have been framed to suit working by the villagers, or by a contractor. The rules are very similar to those for the Coringa Sector 199 55

Tabular statement of fellings.—There are four tabular statements, namely :— 200 56

(1) Tabular statement of fellings for the Coringa Sector. 56

(2) Abstract of wooded areas to be felled annually in the Coringa Sector. 56

(3) Unallotted coupes in the Coringa Sector. 56—57

(4) Tabular statement of fellings for the Kandikuppa Sector ..

	PARA.	PAGE.
General remarks on subsidiary silvicultural regulations— Climbers do very little damage in the mangrove forests, and cleaning or thinning is unnecessary. Reference is made to three questions that need consideration :—	201	57
(1) Does *Acanthus illicifolius* promote or retard regeneration ?		57
(2) Is it possible to regenerate the large natural blanks artificially ?		57
(3) What measures are necessary to expedite the natural regeneration of the newly formed accretions ?		57
The control of Acanthus illicifalious.—The District Forest Officer will record observations in the Control Journal in relation to the first question in paragraph 201. If necessary he will carry out experiments	202	57
The regeneration of the large natural blanks.—The question is briefly discussed and it is prescribed that the District Forest Officer, in consultation with the Provincial Silviculturist, will carry out experiments such as sowing Babul seed, and planting cuttings of *Thespesia populnea*	203	57–58
Afforestation of the new accretions.—The question is briefly discussed, the damage done by fishing is referred to, and an experiment is prescribed	204	58
Survey and demarcation of the coupes.—(1) The coupes will be surveyed, and demarcated before the 15th February	205	58
(2) In April the unfelled portions of the coupes of the previous year will be surveyed and coupe stones planted		58
(3) The coupe lines will be maintained for five years after felling		58
Grazing regulations for the Coringa Sector.—The difficulties relating to grazing in the mangrove forests are briefly discussed. It is prescribed that the working circle will be open to grazing from 1st July to 31st December and closed to grazing during the rest of the year. All coupes will be closed to grazing for five years after felling	207	58–59
Grazing regulations for the Kandikuppa Sector.—The whole of the Kandikuppa Sector will be permanently closed to grazing	208	59
Removal of dead wood.—The fisherman using the creeks of Coringa and Coringa Extension reserves will be permitted to collect dry fuel on payment of a fee of Re. 1 per boat for a period of four months. The necessity for this prescription is explained	209	59
Control.—Sample control forms are contained in Appendix VIII, and instructions are given on the maintenance of the control records	211 to 214	59–60

III. THE MANGROVE COPPICE WORKING CIRCLE.

	PARA.	PAGE.
Constitution of the working circle.—The working circle includes all the mangrove forests that can be regenerated by simple coppice. It is confined to the Upputeru reserve	215	60
Division into blocks.—The Upputeru reserve has been divided into two blocks—	217	60
(1) The Dongapandi block, situated west of the right bank of the Dongapandi		60
(2) The Losari block, covering the rest of the reserve		60
Subdivision into compartments.—Each block is divided into four compartments. A tabular statement shows the distribution and area of the compartments	218	60
Subdivision of the working circle.—The working circle contains four felling series—	219	61

	ACS.
(1) The Dongapandi felling series	2,440
(2) The Kottupusalamuri felling series	1,909
(3) The Losari felling series	1,777
Total	**6,126**

	PARA.	PAGE.
The necessity for the formation of these felling series is explained.		61
Analysis of the crop.—The method of analysis adopted for the purpose of the working plan is explained	220	61

	PARA.	PAGE.
Valuation of the crop.—The valuation of the crop has not been attempted for want of reliable data	221	61
Method of treatment.—The silviculture of the principal species is briefly discussed in this paragraph. The silvicultural system is simple coppice	222 and 223	61
Rotation.—The rotation is 15 years. It is estimated that the crop will attain a mean girth of 10 inches in this period	224	61
Regulation of the yield.—The yield is prescribed and regulated by area	225	61
Method of executing the jellings.—It is intended that the coupes should be worked by the villagers themselves. If this proves impracticable; contractors will be employed to supply the villagers with fuel	226	61
Felling rules.—There are six felling rules : one fixes the period of the lease ; three rules prescribe the manner in which the felling will be executed ; a fourth rule provides for the removal of all slash and obstructions from the creeks within the coupes ; and the last rule relates to the collection of figures of yield	227	61–62
Allotment of coupes.—Coupes have been allotted for the whole period of the rotation	228	62
Tabular statement of fellings.—There are two tabular statements—		
(1) Tabular statement of fellings.		62
(2) Abstract of wooded areas to be felled annually		63
General remarks on subsidiary silvicultural operations.—Climbers do very little damage to the growing stock, and neither cleaning nor thinning is necessary. Reference is made to the want of natural regeneration, and the need of protection against damage by men and cattle	229	63
Replenishment of the growing stock in the felled coupes.—The subject is briefly discussed, and it is prescribed that experiments with Tamarix, Babul, and *Thespesia populnea* will be carried out in the felled coupes in consultation with the Provincial Silviculturist ..	230	63
Surveying and demarcation of coupes.—(1) The coupes will be surveyed and demarcated before the 15th February	231	63
(2) The unfelled portions of the coupes of the previous year will be surveyed in April, and coupe stones will be erected ..		63
(3) The coupe lines will be maintained for five years, corresponding with the period of closure to grazing..		63
Grazing regulations.—The grazing question is briefly discussed, and the following rules prescribed :—	232	64
(1) Compartments 2, 3 and 4, with an aggregate area of 4,700 acres, are open to grazing without let or hindrance. Cattle grazing in these compartments need not be accompanied by a grazier		64
(2) All cattle grazing within the Mangrove Coppice Working Circle must be accompanied by a grazier		64
(3) Coupes will be closed to grazing for five years after felling.		64
(4) In certain coupes, which have been mentioned, large blanks adjoin village lands. These blanks will remain open to grazing at all times		64
Fishing in the creeks and blanks.—The matter is discussed ; and the present system of permitting fishing in the creeks and blanks on payment of small fees will be continued. The poisoning of fish with Tilla juice or other fish poisons is prohibited	233	64
Removal of dead wood.—The removal of dead wood is prohibited ..	234	64
Control.—Sample control forms for this working circle will be found in Appendix VIII	235	64

IV. THE CASUARINA PLANTATION WORKING CIRCLE.

	PARA.	PAGE.
Constitution of the working circle.—Compartment 12 and sub-compartment 13 (*a*) of Kandikuppa block constitute the working circle. It includes the Casuarina plantation, the sandy beach between the plantation and the Bay of Bengal, and the Sacramento ditch ..	236	65
Subdivision of the working circle.—The working circle is divided into eight sub-compartments which are briefly described in a tabular statement	239	65–66
Planting sections.—To facilitate location, organization, and control, the plantation is divided into 80 planting sections. A tabular statement shows the distribution and area of the sections ..	240	66

	PARA.	PAGE
Felling series.—There will be only one felling series	241	66
Analysis of the crop.—The manner in which the crop was analysed for the purpose of this working plan is explained	242	67
Valuation of the crop.—No attempt has been made to value the crop	243	67
Method of treatment.—The silviculture of Casuarina is briefly summarized. The treatment prescribed is clear-felling and planting ..	244 and 245	67
Rotation.—The rotation is ten years. The reasons for adopting this rotation are briefly explained	246	67
Regulation of the yield.—The yield is prescribed and regulated by area	247	68
Felling agency.—For the first three years the fellings will be executed departmentally. Reasons are given for this prescription ..	248	68
Felling rules.—The period of felling will be from April to June. Fellings will be conducted in accordance with the rules prescribed in this paragraph	249	68
Order of felling.—A tabular statement shows the order in which the coupes and sections will be felled	250	68
Removal of stumps.—In the rains, after all produce has been removed, the stumps will be extracted with a stump puller	251	69
Collection of seed.—A one-acre plot of the best quality has been thinned heavily for the production of seed. Seed will be collected from this plot, but if it fails to produce sufficient seed, the selection will be made from well grown dominant trees in first quality crops	252	69
Nursery work.—On an average about 70,000 plants will be wanted for planting in July, and 20,000 plants for replacing casualties in the year of planting. Nursery work will commence about the middle of December, for which full details are given	253	69
Planting.—Planting will be done when the rains break. Special care must be taken that the tap root is not bent in planting ..	256	70
Watering.—The plants will be watered during breaks in the rains, in the first hot weather after planting, and at other seasons in the first year if the plants appear to need water. Watering will be continued during breaks in the rains of the second year if necessary	257	70
Pruning.—In the fourth year after planting all side branches will be pruned from 7 to 8 feet above ground	258	70
Thinning.—The thinning of Casuarina plantations is briefly discussed. Thinnings will be carried out in the sixth year. Two simple rules are prescribed for thinning	259	70–72
Thinning experiments.—Certain experiments are prescribed to determine the best method of thinning Casuarina. Full details are given	259	72
Eradication of climbers.—The climber *Leptodenia reticulata* will be eradicated in the coupes that are felled, planted, pruned and thinned each year	260	72
Grazing.—All coupes under four years old will be closed to grazing and protected with a barbed wire fence	261	72
Demarcation.—The manner in which the demarcation will be carried out is prescribed	262	72
Experiment to determine the correct rotation.—In order to determine the correct financial rotation before the next revision of the working plan, sample plots will be laid out in coupes I to V ..	263	72
Planting palmyra trees.—A line of palmyra trees will be planted at an espacement of 10 feet along the northern and eastern boundaries	264	72
Planting the Sacramento ditch.—An attempt will be made to plant the Sacramento ditch—sub-compartments 12 (*b*) and 12 (*c*)—as rapidly as possible. Details are prescribed	265	72–73

	PARA.	PAGE.
Annual calendar of works.—An annual calendar of works shows the operations to be carried out in the working circle each year ..	266	73
Monthly calendar of operations.—A monthly calendar of operations shows the work to be done in the plantation each month ..	267	73–74
Cost of the plantation.—Details are given showing the cost of the Kandikuppa Casuarina Plantation. The mean cost per acre, all in, is estimated at Rs. 29-7-0	268	74–75
Estimated yield.—The mean yield per acre from the plantation is estimated at 25 tons	269	75
Forecast of revenue.—A tabular statement shows the estimated average annual revenue and expenditure	270	75
Control records.—Sample forms of the control records will be found in Appendix VIII	271	76

V. The Timber Clear-felling Working Circle.

	PARA.	PAGE.
General constitution of the working circle.—The working circle covers the workable teak forests of Beddadanole and Kopalli reserves, and Kovvada block I—Details are given	272	76
Division into blocks.—It has been considered unnecessary to subdivide the forests into blocks	274	76
Subdivision into compartments.—The teak areas of Beddadanole reserve form 35 compartments ; while there is a single series of 26 compartments in Kopalli reserve and Kovvada block I. A tabular statement shows the distribution and area of the compartments	275	76–77
Felling series.—There are two felling series— ACS. (1) The Beddadanole felling series .. 1,632 (2) The Puliramudugudem felling series .. 1,261 ..	276	77
Method of treatment.—The method of treatment is described in detail. The forests will be worked on the Walayar system ..	280	78–79
Rotation.—The rotation is 50 years	281	79
Regulation of the yield.—The yield is prescribed and regulated by area	282	79
Felling rules.—There are six felling rules, which will apply to both felling series	283	79
Tabular statement of fellings.—Coupes have been allotted for the period of the working plan. A tabular statement of fellings shows the areas to be worked each year	284	79
Regeneration.—The coupes will be regenerated partly by coppice and partly with teak stumps. The method is described	285	80
Preliminary work.—The preparation of the coupe for regeneration will start in the first week of May. Lining out and burning will be carried out as prescribed	286	80
Stumping.—The coupe will be staked out for stumping in the last week of May. Teak stumps will be planted in crowbar holes in the first week of June. Certain details and precautionary measures are prescribed	287	80
Collection of seed.—The sources of supply are discussed. The District Forest Officer will endeavour to obtain his full requirements from straight, well-grown, healthy trees	288	80
Nursery work.—Approximately 62,000 one-year-old teak stumps will be required each year by the beginning of June, 36,000 for the Beddadanole felling series, and 26,000 for the Puliramudugudem felling series. Detailed instructions for nursery work, drafted by the Provincial Silviculturist, are incorporated in the working plan	289	81
Replacement of casualties.—All failures in pre-monsoon stumping will be replaced when the rains break. Casualties will be replaced again along with the first weeding	290	81
Necessity of good organization.—The necessity of good organization is emphasised	291	81
Preliminary climber cutting.—In March, a month before fellings commence, all climbers will be cut in the coupe to be felled. Different methods of climber cutting are prescribed	293 (1)	81

	PARA.	PAGE.
First weeding.—The first weeding will be carried out in August of the year of regeneration on the lines prescribed in the plan	293 (2)	82
Second weeding.—There will be a second weeding in December	293 (3)	82
Tending the regenerated areas.—The coupes will be tended in the year after regeneration and again in the sixth year after regeneration on the lines prescribed in the plan. Any intermediate tending that is necessary between these periods will be carried out at the discretion of the District Forest Officer	293 (4 to 6)	82
Tending the old timber coupes.—The old timber coupes will be tended twice during the period of this working plan, on the lines prescribed	294	82
Tending the intermediate compartments.—Climber cutting will be carried out in the intermediate compartments on a cycle of five years	295	82
Tabular statements.—Tabular statements show the work to be done each year, and the operations to be carried out each month	296	82–84
Demarcation.—Demarcation will be progressive	297	84
Fire protection.—Fire is a serious menace, particularly in the Beddadanole felling series. Three forms of protection are prescribed—	298	84
(1) Indirect—The sequence of the coupes on the ground will be broken to keep down grass.		84
(2) Direct—(*a*) A system of permanent fire lines will be maintained. (*b*) The regenerated coupes will be fire-traced		84
Grazing.—All regenerated areas will be permanently closed to grazing	299	84
Control.—Samples of the control records will be found in Appendix VIII	300	85

VI. The Papikonda Experimental Working Circle.

	PARA.	PAGE.
Constitution of the working circle.—The circle includes the workable timber forests situated in the eastern half of Papikonda reserve and in the north-east quarter of Kovvada block II	301	85
Forest blocks.—It is unnecessary to subdivide the area into separate blocks	303	85
Compartments.—There are 11 compartments in the working circle. A tabular statement shows the location and area of each compartment	304	85–86
Analysis of the growing stock.—The necessity for analysing the growing stock, and the manner in which the analysis was carried out are explained. The results are summarised in the following four statements :—	305–308	86–88
(1) Estimated quantities and distribution of timber in the Papikonda Experimental Working Circle		87
(2) Species abstract		87
(3) Distribution and estimated yield of teak		88
(4) Analysis of principal species		88
Method of treatment.—The treatment to be applied to the working circle has been discussed under the following heads :—	309 to 313	89-91
(1) Facts influencing the management	309	89
(2) The extraction scheme	310	89
(3) The economic position	311	89–90
(4) The silvicultural position	312	90
(5) The management difficulties	313	90–91
These cannot be effectively summarised. The teak compartments, and those that contain no teak will be subjected to different methods of treatment	314	91
Treatment of the teak compartments.—The teak compartments have been divided into 8 coupes to be worked from 1936–37 to 1943–44. As large an area as can be managed with the labour available will be clearfelled and planted in the parts of each coupe suitable for concentrated regeneration marked on the map. The rest of the coupe will be worked by selection fellings in the manner prescribed.	314–A	91
Treatment of the compartments that contain no teak.—These compartments have not been divided into coupes. They will constitute a reserve timber supply to be worked at the discretion of the District Forest Officer in the manner prescribed	314–B	91

	PARA.	PAGE.
Regulation of the yield.—The yield will be prescribed and regulated by area	315	91
Method of executing the fellings.—Until the coupes can be sold standing to contractors they will be worked departmentally. Two felling rules are prescribed. If additional rules are necessary they may be prescribed by the District Forest Officer	316	91
Tabular statement of fellings.—A tabular statement of fellings shows the location and area of teak coupes. Felling will commence in 1936	317	92
Regeneration of the clear-felled plots.—The District Forest Officer will be responsible for the regeneration of all clear-felled areas. They will be planted with teak stumps at an espacement of 6′ × 6′ ..	318	92
Regeneration of the areas worked by selection fellings.—Regeneration will be left to nature. Certain rules are prescribed	319	92
Weeding and cleaning.—These operations will be carried out more or less on the same lines as in the Timber Clear-felling Working Circle. The District Forest Officer is responsible for the satisfactory tending of the crop	320	92
Thinning.—The plantations will be examined for thinning when they are five years old, and annually thereafter until they are thinned	321	92
Preliminary climber cutting.—Preliminary climber cutting, on the same lines as in the Timber Clear-felling Working Circle, will be carried out in March before the coupe is felled	323	93
Climber cutting in other compartments.—A programme of climber cutting will be carried out by the District Forest Officer in relation to the labour that is available for this purpose. The sequence of working is suggested	324	93
Demarcation.—Brief instructions are given on the order of demarcation	325	93
Fire protection.—The permanent fire lines have been marked on the working plan map. A fire line 30 feet wide will be maintained around all regenerated plots	326	93
Protection against grazing.—All coupes will be closed to grazing after felling, and will remain closed throughout the period of the plan ..	327	93
Malaria.—The District Forest Officer will pay close personal attention to the prevention of Malaria	328	93

VII. THE UPLAND COPPICE WORKING CIRCLE.

	PARA.	PAGE.
Constitution of the working circle.—It comprises all areas in the mixed deciduous forest that can be worked for fuel. It covers the fuel forest on the flat ground of Sudikonda, Tirumalayapalem and Mallavaram reserves, and the two Devancheruvu blocks ..	330	94
Blocks and compartments.—The formation of blocks and compartments is unnecessary. The reserves will serve as blocks and the coupe will be the unit for management purposes	332	94

Sectors.—The working circle will be divided into two sectors :—

	ACS.
The Sudikonda Sector	5,723·5
The Devancheruvu Sector	2,064·0
Total area ..	7,787·5

	PARA.	PAGE.
The necessity for the formation of Sectors is explained	333	94
Felling Series.—The Sudikonda Sector has been subdivided into four felling series :—	334-A	94

	ACS.
(1) Sudikonda felling series	1,834·5
(2) Tirumalayapalem North felling series ..	1,223·5
(3) Tirumalayapalem South felling series ..	1,194·0
(4) Mallavaram felling series	1,471·5
Total area ..	5,723·5

	PARA.	PAGE.
The Devancheruvu Sector has been subdivided into two felling series :—	344 B	95

	ACS.
(1) Devancheruvu, East	747·5
(2) Devancheruvu, West	1,299·5
Total area	2,046·5

	PARA.	PAGE.
The reasons for the formation of the felling series is explained.		
Method of treatment.—The silvicultural condition of the crop in the two sectors, and the treatment necessary to improve the crop, is discussed. The silvicultural system will be simple coppice	337 to 339	95–96
Rotation.—The rotation fixed for the Sudikonda Sector is 30 years and for the Devancheruvu Sector, it is 25 years. The reasons for adopting these rotations are explained	340	96
Regulation of the yield.—The yield will be prescribed and regulated by area	341	97
Method of executing the felling.—Seven felling rules have been prescribed, which will apply to both sectors. They cannot be effectively summarised	342	97
Tabular statement of fellings.—Coupes have been allotted for the period of the rotation, but they have been marked on the maps for the whole rotation. The following tabular statements are included :—	343	97–98
(1) Tabular statement of fellings for the Sudikonda Sector.		
(2) Tabular statement of fellings for the Devancheruvu Sector.		97
(3) Tabular statement of unallotted coupes in the Upland Coppice Working Circle		98
Rab sowings.—Rab sowings will be confined to the Sudikonda Sector. Detailed prescriptions are given for the rab sowings	344	98–99
General tending of the coupes.—The following rules apply to both felling series :—		99
(1) The year after felling, climbers will be cut and all soft woods will be cut back from 18″ to 24″ above ground.		99
(2) There will be a second climber cutting six years after felling and the coppice crop will be cleaned by felling all dominant soft woods	345	99
Demarcation.—Coupes to be felled in April will be demarcated before the 15th February—widths of the lines are prescribed. Coupe stones of the standard pattern will be erected the year after felling. Coupe lines will be maintained for ten years after felling corresponding with the period of closure to grazing	346	99
Fire protection.—The outer boundaries of all coupes or groups of coupes will be fire traced to a width of 30 feet until the coupes are ten years old	347	99
Grazing.—Coupes will be closed to grazing for ten years including the year of felling	348	99
Control.—Samples of the control records will be found in Appendix VIII	349	99

VIII. THE TEAK CONVERSION WORKING CIRCLE.

	PARA.	PAGE.
Objects of the working circle.—The objects of this working circle are explained	350	100
Constitution of the working circle.—The working circle includes all the Lankas of Peddapur and Gokavaram ranges that are considered to be suitable for planting teak and where there is sufficient saleable timber to cover the cost of conversion	351	100
Blocks.—The formation of blocks is unnecessary	353	100
Compartments.—Each lanka forms a separate compartment. There will be one series of 40 compartments covering both ranges. A tabular statement shows the location and area of the compartments	354	100

	PARA	PAGE.
Felling series.—There will be two felling series :—		
(1) The Northern felling series situated in Peddapur range, comprising compartments 1 to 24 with a total area of 786 acres.	355	101
(2) The Southern felling series situated in Gokavaram range comprising compartments 25 to 40 with a total area of 383·7 acres. Reasons are given for the formation of the two felling series ..	355	101
Method of treatment.—The treatment of the working circle is discussed. The silvicultural system will be clear-felling ; and planting with one year old teak stumps at an espacement of 6′ × 6′ ..	358 and 359	101
Rotation.—The rotation is 50 years. Reasons for adopting this rotation are given	360	101
The period of conversion.—The period of conversion will be 50 years—the same as the rotation	361	101–102
Regulation of the yield.—The yield is prescribed and regulated by area	362	102
Felling agency.—The coupes in the southern felling series will be worked by contractors. The coupes in the Northern felling series will be worked departmentally until contractors want the coupes.	363	102
Felling rules.—There are only three felling rules :—		
(1) Fellings will commence at the beginning of December and will be completed by the end of January.		
(2) The entire crop will be clear-felled including bamboos and species that yield minor produce.		
(3) The trees and bamboo clumps are to be felled as low as possible : not more than one foot above ground.		
A tabular statement shows the areas to be felled during the period of the plan	364 and 365	102
Nursery work.—Nurseries will be established at convenient places to be chosen by the District Forest Officer. Seed will be collected from Polavaram range. About 30,000 stumps will be wanted each year—14,500 for the Southern felling series and 15,500 for the Northern felling series. The methods adopted for nursery work will be the same as in the Timber Clear-felling Working Circle ..	366	102
Preparation of the ground.—The coupes will be burnt in the first week of April and staked for planting in the middle of May	367	102
Planting.—Planting will commence at the end of May or early in June according to the season. Details are prescribed	368	103
Replacement of casualties.—Failures at the stakes will be replanted when the rains break and subsequent casualties will be replaced with the first weeding	369	103
First weeding.—The time of the first weeding will depend on the weather. It will ordinarily be about the end of August. Different methods are prescribed	370	103
Second weeding.—The second weeding will be done whenever necessary but not later than the end of December	371	103
Nipping off the heads of superfluous shoots.—If teak stumps throw out more than one shoot, the heads of the superfluous shoots will be nipped off with the second weeding	372	103
Subsequent weeding, climber cutting and cleaning.—Subsequent weeding, climber cutting and cleaning will be carried out at the discretion of the District Forest Officer	373	103
Pruning.—The plantation will be pruned along with the third weeding. Details are prescribed	374	103
Subsidiary tending.—The plantations will be examined in the third and fourth years to ascertain whether climber cutting or other tending is necessary	375	103
Thinning.—The subject is discussed. Thinnings will be carried out in accordance with the silvicultural requirements of the crop. The plantations will be inspected by the District Forest Officer for thinning when they are five years old and annually thereafter until they are thinned	376	104
Tending the intermediate compartments.—Climber cutting on a five years cycle will be carried out in the compartments that will not be taken up for conversion during the period of this plan	377	104

	PARA.	PAGE.
Demarcation.—The coupes to be felled in December will be demarcated before the end of October ; and the intermediate compartments for climber cutting will be demarcated before the end of June ..	378	104
Fire protection.—The outer boundary of all planted area will be fire-traced to a width of 50 feet	379	104
Grazing.—All planted coupes will be premanently closed to grazing.	380	104
Tabular statements.—An annual calender of works and a monthly calendar of operations are included	381	104–106
Control.—Sample control forms will be found in Appendix VIII ..	382	106

IX. The Bamboo Working Circle.

	PARA.	PAGE.
Constitution of the working circle.—The working circle covers all areas that contain bamboo in sufficient quantity for remunerative working. Details are given	383	106
Position in relation to other working circle.—The position in relation to other working circles is explained	384	107
Area and distribution.—A tabular statement shows the distribution of the bamboo working circle by ranges, and the approximate areas under *Dendrocalamus and Bambusa* in each range	386	107
Analysis of the crop.—The manner in which the bamboo forests were analysed for the purposes of this plan is explained	387	107–108
Felling cycle.—The felling cycle is discussed. It is fixed at three years	390	108
Felling series.—The working circle has been divided into 16 felling series. A tabular statement shows the distribution, location and areas of the felling series	392	108–109
Location of the bamboo coupes.—The manner in which the coupes have been fixed is described. A tabular statement describes the locations and boundaries of each coupe	393	109–115
Method of treatment.—The silvicultural treatment is discussed under the following heads :— (1) The intensity of felling, (2) The method of felling, and (3) The height at which the culms may be cut. The method of treatment will be clear-felling of the older halves of the clumps	394–397	115–116
The felling rules.—There are only two felling rules— (1) Fellings will not be permitted in any clump that contains less than ten culms. (2) Fellings will be restricted to a half of each clump—the half that is diametrically opposite to the largest number of new culms ..	398	116
Tabular statement of fellings.—Tabular statements show the areas to be felled each year, throughout the period of the plan, in all 16 felling series	399	116–117
Period of lease.—The coupe will be leased for the felling cycle of three years	400	118
Emergency regulations in the event of gregorious flowering.—Certain emergency regulations are prescribed to cover areas that flower gregariously during the period of the working plan	401	118
Grazing.—No closure to grazing is prescribed	402	118
Fire protection.—No special fire protection measures are necessary..	403	118
Control.—A sample of the control form will be found in Appendix VIII	404	118

X. The Minor Products Working Circle.

	PARA.	PAGE.
Constitution of the working circle.—The working circle includes the entire area covered by this plan	405	118
The minor products of the Lower Godavari division.—A classified list is given of the chief minor products of the Lower Godavari division.	406	118–119
Methods of collection and disposal.—The three methods in use are enumerated	407	119
Produce leased to contractors.—A list shows the produce leased to contractors	408	119

	PARA.	PAGE.
Produce on which seigniorage is levied.—A list shows the produce on which seigniorage is levied	409	119
Produce sold on permits.—A list shows the produce sold on permits ..	410	119
Methods of harvesting and disposal.—This is left to the discretion of the District Forest Officer	411	119
Suggestions.—Certain suggestions are made relating to tamarind, Gedara bark, fodder and thatching grass, and the privileges of the Agency tribes	412 to 415	119
Control.—A sample form of the control book is given in Appendix VIII	416	120

XI. The Grazing Working Circle.

	PARA.	PAGE.
Constitution of the working circle.—The Grazing Working Circle includes the whole area covered by this working plan except certain specially protected areas and the felled coupes which are closed to grazing for fixed periods	417	120
Specially protected areas permanently closed to grazing.—A list is given of the areas that are specially protected and closed to grazing ..	418	120
Periodic closure to grazing.—The areas that will be closed to grazing for fixed periods are listed	419	120–121
Comparison with closure to grazing under the current scheme.—The closure prescribed under this working plan is compared with the closure now in force	420	121
Conditions that influence the regulation and control of grazing.—The conditions that influence the regulation and control of grazing are explained	421	121
Grazing fees.—In G.O. No. 1126, Development, dated 15th September 1933, it was decided that the revision of grazing fees should be deferred for the present.	422	121
The grazing unit.—The grazing unit is the range or the whole division at the option of the graziers	423	122
Seasonal grazing in the Coringa Sector.—The Coringa Sector will be open to grazing from July to December, and closed for the rest of the year	424	122
Herding cattle in the mangrove swamps.—This matter is discussed and certain rules are framed	425 and 426	122
Rounding-up unowned cattle.—An attempt will be made to round up all unowned cattle in the Coringa reserves and the Kandikuppa Casuarina Plantation	427	122
Removal of fodder grass.—The free removal of fodder grass will be permitted and encouraged in all the reserved forests of the Uplands and the Agency	429	122
Closure of burnt areas.—The matter is discussed and closure is left to the discretion of the District Forest Officer	430	122
Experiments with fodder grasses.—Certain experiments are suggested.	431	122–123
Control.—A control book and a grazing map will be maintained. A sample form for the control book will be found in Appendix VIII ..	433	123

XII. Miscellaneous Prescriptions.

	PARA.	PAGE.
General remarks on fire protection.—The causes and prevention of fires in the Lower Godavari division are briefly discussed	434	123
Measures prescribed for fire protection— (1) The prevention of incendiarism is an administrative matter which is left to the vigilance of the District Forest Officer. (2) Paths connecting the village enclosures in Papikonda and Kopalli reserves and Kovvada block II, to be selected by the District Forest Officer, will be fire traced to a width of 15 feet on each side. (3) Fire protection is unnecessary in Rajahmundry range. (4) The other three ranges will be protected by a system of permanent fire lines. Tabular statements show the location and areas of the fire lines in each reserve. (5) The regenerated areas that need special protection are referred to.	434	123–124

	PARAGRAPH	PAGE
(6) All permanent fire lines have been marked in the working plan maps.	435	124
Roads and other export works.—The road construction necessary in each range for the purposes of this working plan is detailed ..	436 to 439	124–125
Improvement of waterways and water supply—		
(1) Certain remarks and suggestions are made about the maintenance of the waterways in Coringa and Coringa Extension reserves.	440	125–126
(2) The construction of wells at Puliramudugudem and Bothappagudem is prescribed	441	126
Buildings.—		
(1) The new buildings necessary for the purposes of this working plan are listed separately according to working circles	442	126
(2) A list is given of the capital improvements necessary to existing buildings	443	126
(3) The order of executing the works is left to the discretion of the District Forest Officer	444	126
(4) The capital expenditure on bungalows for the period ot the plan is estimated at about Rs. 15,000	445	126-127
Launches and boats.—		
(1) The unsuitability of the 'Thistle' and the 'Avicennia' is referred to, and suggestions are made for a suitable type of motor boat	446	127
(2) Six Navas will be supplied to the beat staff of Coringa, Coringa Extension of Upputeru reserves	447	127
(3) It is suggested that the Range Officer, Rajahmundry range, should be supplied with Rhaderi boat when funds permit ..	447	127
Game preservation.—A few simple rules are prescribed to promote the preservation of game	448	127

XIII. STAFF AND LABOUR.

	PARAGRAPH	PAGE
Staff.—No additional staff is necessary for the purposes of this working plan, nor will it be possible to make any immediate reduction in the staff. The redistribution that is necessary to carry out the prescriptions of this plan will be left to the discretion of the District Forest Officer	449	127
Labour.—Labour is sufficient for all purposes except for the work to be carried out in the Papikonda Experimental Working Circle, and for the extraction of bamboos in parts of Polavaram range. It will be necessary to recruit a small labour force for work in the Papikonda Experimental Working Circle	450	127

XIV. FINANCIAL FORECAST.

	PARAGRAPH	PAGE
Forecast of revenue and expenditure.—		
(1) The financial forecast shows the anticipted revenue from each working circle, and from other sources ; and the anticipated expenditure in each working circle, and on the general administration of the division	451	128–30
(2) The average annual revenue is estimated at Rs. 1,57,000 and the average annual expenditure at Rs. 1,05,000, leaving a surplus of Rs. 52,000 per annum. The average surplus for the past three years—a period of depression—from the areas covered by this working plan, was Rs. 29,000	452 to 456	131 -133

APPENDIX I (*a*).

LIST OF TREES, SHRUBS AND CLIMBERS IN THE FORESTS OF THE LOWER GODAVARI DIVISION ARRANGED BY NATURAL ORDERS.

Natural order. (1)	Botanical name. (2)	Vernacular name. (3)	Page in Flora of the Madras Presidency. (4)
	A.—Trees.		
Dilleniaceae	*Dillenia pentagyna*	Revadi	8
Magnoliaceae	*Michelia champaca*	Pogada	9
Anonaceae	*Polyalthia cerasoides*	Chilaka dudduga	17
	Anona squamosa	Sithaphalam	20
	Miliusa velutina	Peda-chilaka-dudduga	21
	Saccopetalum tomentosum	Budda-dudduga	22
Capparidaceae	*Crataeva religiosa*	Vulimidi	47
Bixaceae	*Cochlospermum gossypium*	Konda-gogu	50
	Flacourtia ramontchi	Puthika-thada	54
Tamaricaceae	*Tamarix gallica*	Parivili	67
Malvaceae	*Kydia calycina*	Konda-pothari	93
	Bombax malabaricum	Buruga	99
	Thespesia populnea	Gangaravi	101
Sterculiaceae	*Sterculia urens*	Erraponaku, Thapasi	106
	Sterculia villosa	Kummaraponaku	106
	Pterospermum heyneanum	Thada	108
	Pterospermum suberifolium	Loluga	109
	Guazuma tomentosa	Rudraksha	111
Tiliaceae	*Grewia tiliaefolia*	Thada	118
Linaceae	*Erythroxylon monogynum*	Devadari	127
Rutaceae	*Chloroxylon swietenia*	Billudu	152
	Limonia crenulata	Thorrivelaga	157
	Atalantia monophylla	Adavi-nimma	159
	Feronia elephantum	Velaga	160
	Aegle marmelos	Maredu	161
	Citrus medica	Nimma	161
Simarubaceae	*Ailanthus excelsa*	Peddamanu	163
	Balanites roxburghii	Gara	164
Ochnaceæ	*Ochna squarrosa*	Erra-juvvi	165
Burseraceæ	*Garuga pinnata*	Garugudu	169
	Protium serratum	Chitrek	171
Meliaceæ	*Melia azedarach*	Thuraka-vepa	176
	Melia composita	Munnuti-karaka	176
	Azadirachta indica	Vepa	177
	Xylocarpus obovatus	Senuga	185
	Soymida febrifuga	Somi	185
	Chukrasia tabularis	Konda-vepa	186
Celastraceæ	*Gymnosporia montana*	Chinni	209
	Pleurostylia wightii	Kuntichinta	211
	Elædendron glaucum	Bhutankusam	211
Rhamnaceæ	*Zizyphus jujuba*	Regu	219
	Zizyphus xylopyrus	Gotti	220
Sapindaceæ	*Schleichera trijuga*	Busi	248
	Sapindus emarginatus	Kunkudu	250
Anacardiaceæ	*Buchanania lanzan*	Sara	258
	Buchanania lanceolata	Pandi-jaruga	259
	Mangifera indica	Mamidi	259
	Anacardium occidentale	Jeedi-mamidi	260
	Spondias mangifera	Adavi-mamidi, Ambada	261
	Odina wodier	Gumpena	263
	Semecarpus anacardium	Nalla-jeedi	266
Moringaceæ	*Moringa concanensis*	Adavi-munaga	270
Leguminosæ	*Ougenia dalbergioides*	Chikkudu	340
	Erythrina indica	Baditha	353
	Erythrina suberosa	Moduga, Mullumoduga	354
	Butea frondosa	Moduga	357
	Dalbergia latifolia	Jittegi, Viruguduchava	383
	Dalbergia paniculata	Porla-pachari	383
	Dalbergia lanceolaria	Nagalla-pachari	383
	Pterocarpus marsupium	Yegisi	385
	Pongamia glabra	Kanuga	385
	Cœsalpinia coriaria	Divi-divi	394
	Delonix elata	Vata-narayana	396
	Cassia fistula	Rella	400
	Bauhinia racemosa	Ari	406
	Bauhinia retusa	Goddari	407
	Bauhinia variegata	Devakanchanamu	407
	Bauhinia purpurea	Peddari, Kanchanamu	407
	Tamarindus indica	Chinta	409
	Hardwickia binata	Yepi	412
	Xylia xylocarpa	Konda-thangedu	417
	Prosopis spicigera	Jammi	419
	Dichrostachys cinerea	Velthuru	419
	Acacia arabica	Nalla-thumma	425
	Acacia leucophlœa	Thella-thumma	427
	Acacia sundra	Sundra	428
	Acacia ferruginea	Vanne-sundra	428

Natural order. (1)	Botanical name. (2)	Vernacular name. (3)	Page in Flora of the Madras Presidency. (4)
	A.—Trees—cont.		
Leguminosæ—*cont.*	*Albizzia procera*	Thella-chinduga	431
	Albizzia odoratissima	Chinduga	431
	Albizzia lebbek	Dirisena	432
	Albizzia amara	Nalla-regu	432
	Pithecolobium dulce	Sima-chinta	434
	Enterolobium saman	Nidara-ganneru	435
Rhizophoraceæ	*Rhizophora mucronata*	Uppu-ponna	456
	Rhizophora candelaria	Uppu-ponna	456
	Ceriops roxburghiana	Gedara	457
	Bruguiera conjugata	Urudu	458
	Bruguiera cylindrica	Kandilla	459
Combretaceæ	*Terminalia belerica*	Thadi	463
	Terminalia chebula	Karaka	464
	Terminalia arjuna	Tella-maddi, Yeti-maddi	465
	Terminalia tomentosa	Nalla-maddi, Maddi	465
	Anogeissus latifolia	Chirimanu	466
	Anogeissus acuminata	Pasi	467
	Lumnitzera racemosa	Thanduga	468
Myrtaceæ	*Syzygium jambolanum*	Neeredu	481
Lecythidaceæ	*Barringtonia acutangula*	Kadem	487
	Careya arborea	Kumbhi	488
Melastomaceæ	*Memecylon edule*	Alli	504
Lythraceæ	*Lagerstroemia parviflora*	Chennangi	512
	Lawsonia inermis	Gorintha	514
Sonneratiaceæ	*Sonneratia apetala*	Kalinga	515
	Sonneratia alba	Peda-kalinga	..
Samydaceæ	*Casearia tomentosa*	Girugudu	521
Alangiaceæ	*Alangium salvifolium*	Uduga	572
Rubiaceæ	*Adina cordifolia*	Bandaru, Dadduga	584
	Mitragyna parvifolia	Botruga, Battaganapa	585
	Hymenodictyon excelsum	Dudippa	589
	Randia uliginosa	Nalla-manga	615
	Gardenia gummifera	Manchi-bikki	618
	Gardenia lucida	Yerri-bikki	618
	Gardenia latifolia	Karinguva, Pedda-bikki	619
	Plectronia didyma	Neeralli	624
	Ixora parviflora	Korivipala	631
	Morinda tinctoria	Thogaru	651
Myrsinaceæ	*Aegiceras corniculatum*	Guggilam	757
Sapotaceæ	*Bassia latofolia*	Ippa	763
	Mimusops elengi	Pogada	765
	Mimusops hexandra	Pala	766
Ebenaceæ	*Maba buxifolia*	Pisiniki	768
	Diospyros melanoxlyn	Thumiki	772
	Diospyros sylvatica	Gatha	773
	Diospyros montana	Yerra-gatha	776
	Diospyros chloroxylon	Illinda	776
Oleaceæ	*Nyctanthes arbortristis*	Pogada	792
	Schrebera swietenioides	Mokkam	792
Apocynaceæ	*Holarrhena antidysenterica*	Pala	811
	Wrightia tinctoria	Aku-pala	815
	Wrightia tomentosa	Thedla-pala	816
	Thevetia neriifolia	Pacha-ganneru	821
Loganiceæ	*Strychnos potatorum*	Indupa, Chilla	868
	Strychnos nux-vomica	Musti	868
Boraginaceæ	*Cordia obliqua*	Banka-nakkiri	887
Bignoniaceæ	*Oroxylum indicum*	Pampini	994
	Millingotnia hortensis	Akasa-malli	994
	Dolichandrone falcata	Kodavali	996
	Stereospermum tetragonum	Isikirasi	998
Verbenaceæ	*Tectona grandis*	Teku	1092
	Premna tomentosa	Navuru	1095
	Gmelina arborea	Gummadi	1097
	Gmelina asiatica	Kavva-gummadi	1098
	Vitex negundo	Vavili	1102
	Vitex altissima	Nemali-adugu	1102
	Avicennia officinalis	Nalla-mada	1105
	Avicennia marina	Tella-mada	1106
	Avicennia alba	Vilava-mada	1106
	Avicennia	Gundu-mada	..
Lauraceæ	*Litsea chinensis*	Nara-mamidi	1235
Hernandiaceæ	*Gyrocarpus americanus*	Tanuku	1242
Euphorbiaceæ	*Euphorbia trigona*	Kattimandu	1277
	Bridelia retusa	Anepu, Koramanu	1280
	Bridelia tomentosa	Balli	1281
	Bridelia montana	Pantangi	1281
	Cleistanthus collinus	Kodisa	1282
	Emblica officinalis	Usirika	1295
	Fluggea virosa	Thella-purugudu	1296
	Antidesma ghæsembilla	Pullari	1298
	Breynia rhamnoides	Errapurugudu	1304
	Mallotus philippinensis	Vasantagunda	1322
	Macaranga peltata	Alamanda	1326

Natural order. (1)	Botanical name. (2)	Vernacular name. (3)	Page in Flora of the Madras Presidency. (4)
	A. Trees—cont.		
Euphorbiaceæ—*cont.*	*Givotia rottleriformis*	Tohlla-poliki	1342
	Excœcaria agallocha	Tilla	1344
Ulmaceæ	*Holoptelea integrifolia*	Nemali	1348
	Trema orientalis	Boggu-chettu	1350
Moraceæ	*Streblus asper*	Barrinki	1353
	Ficus tometosa	Juvvi	1361
	Ficus begalensis	Marri	1361
	Ficns retusa	Yerra-juvvi	1362
	Ficus tsiela	Pitta-juvvi	1362
	Ficus religiosa	Ravi	1363
	Ficus glomerata	Atti	1364
	Ficus hispida	Bodda-marri	1367
	Artocarpus integrifolia	Panasa	1369
Casuarinaceæ	*Casuarina equisetifolia*	Sarugudu	1389
Palmæ	*Phœnix sylvestris*	Ita	..
	Borassus flabellifer	Thadi	..
	Caryota urens	Jeeluga	..
Pandanaceæ	*Pandanus tectorius*	Mogali	..
Gramineæ	*Bambusa arundinacea*	Mollem	..
	Dendrocalamus strictus	Sadanam	..
	B.—Shrubs.		
Capparidaceæ	*Cadaba indica*	....	43
	Capparis sepiaria	Nalla-vuppi	46
Malvaceæ	*Pavonia zeylanica*	Karubenda	93
Sterculiaceæ	*Helicteres isora*	Adavi-chamanti	107
Tiliaceæ	*Grewia rothii*	Jana	118
	Grewia hirsuta	Chitti-jana	119
Rutaceæ	*Toddalia asiatica*	Konda-kasintha	150
	Glycosmis cochinchinensis	Golugu	153
	Murraya exotica	Naga-golugu	155
	Murraya konigii	Karuvepaku	156
Oleaceæ	*Ximenia americana*	Nakkiri	189
Sapindaceæ	*Dodonea viscosa*	Bandedu	253
Leguminosæ	*Indigofera parviflora*	Konda-vempali	311
	Tephrosia purpurea	Vempali	320
	Aeschynomene aspera	Jeeluga	331
	Desmodium pulchellum	Kondantitha	344
	Dalbergia spinosa	Chillanki	381
	Cassia occidentalis	Kasinda	401
	Cassia tora	Thantepu	401
	Cassia auriculata	Thangedu	402
Rubiacæ	*Chomelia asiatica*	Kommu-papidi	613
	Randia dumetorum	Manga	615
	Plectronia parviflora	Balusu	625
	Pavetta indica	Papidi	633
Plumbaginaceæ	*Plumbago zeylanica*	Chitramulam	744
	Plumbago rosea	Yerra-chitramulam	745
Myrsinaceæ	*Ardisia solanacea*	Adavi-mayuram	756
Apocynaceæ	*Carissa spinarum*	Vaka	805
	Alstonia scholaris	Edakula-pala	810
Asclepiadaceæ	*Hemidesmus indicus*	Sugandhi-pala	825
	Calotropis gigantea	Jilludu	832
Solanaceæ	*Solanum xanthocarpun*	Ne-la-vakudu	938
	Solanum trilobatum	Vuchinta	938
	Datura stramonium	Vummetta	941
Acanthaceæ	*Acanthus ilicifolius*	Alchi	1014
	Adhatoda vasica	Addasaram	1082
Verbenaceæ	*Clerodendron inerme*	Pisingi	1099
Labiatæ	*Ocimum gratissimum*	Rama-thulasi	1111
	Ocimum sanctum	Krishna-tulasi	1111
Chenopodiaceæ	*Suæda monoica*	Ilakura	1184
	Suæda maritima	Ilakura	1184
Euphorbiaceæ	*Kirganelia reticulata*	Nalla-purugudu	1294
	Croton lawianus	Seema-neepalam	1315
	Jatropha curcas	Pedda-nepalam	1340
Zingiberaceæ	*Zingiber casumunar*	Adavi-pasupu	1490
Liliaceæ	*Alœ vera*	Kithanara	1520
Palmæ	*Phœnix humilis*	Chittetha	..
	Phœnix acaulis	Chittetha	..
	C.—Climbers.		
Menispermaceæ	*Cocculus hirsutus*	....	29
Linaceæ	*Hugonia mystax*	Ungarala-pedum	126
Oleaceæ	*Olax scandens*	Theegi-nakkiri	190
Rhamnaceæ	*Ventilago calyculatta*	Erra-chiratali	218
	Zizyphus œnoplia	Pariki	220
Vitaceæ	*Ampelocissus latifolia*	Adavi-draksha	230
	Cissus quadrangularis	Nalleru	233
	Cissus repens	Nallaboddu	233
	Cissus vitiginea	Bankaboddu	234
Leguminosæ	*Abrus precatorius*	Guruvenda	349
	Abrus pulchellus	Bandi-guruvenda	350
	Mucuna prurita	Enugu-dulagunda	356
	Butea superba	Theega-moduga	358

Natural order.	Botanical name.	Vernacular name.	Page in Flora of the Madras Presidency.
(1)	(2)	(3)	(4)
	C. Climbers—cont.		
Leguminosæ	*Spatholobus roxburghii*	Moduga-theega	358
	Canavalia virosa	Adavi-chemma	359
	Derris scandens	Nalla-theega	387
	Derris uliginosa	Nalla-theega	387
	Cæsalpinia crista	Gecha	3
	Pterolobium indicum	Kodimudusu	395
	Bauhinia vahlii	Adda-theega	408
	Acacia cæsia	Korintha	428
	Acacia concinna	Sheekayi	429
	Calycopteris floribunda	Pippinda-theega	467
Combretaceæ	*Combretum decandrum*	Bontha-theega	468
	Combretum ovalifolium	Vedala-theega	469
Oleaceæ	*Jasminum arborescens*	Adavi-malli	789
Apocynaceæ	*Ichnocarpus frutescens*	Pala-theega	820
Asclepiadeceæ	*Pergularia extensa*	Dustapu-theega	837
Convolvulaceæ	*Leptadenia reticulata*	Mukkuthummudu-theega	850
Verbenaceæ	*Argyrea speciosa*	Palasamudra-theega	907
Aristolochiaceæ	*Ipomœa pes-capræ*	Chevulapalli-theega	917
	Cuscuta reflexa	Seethamma-savaram	931
	Symphorema involucratum	Naguru-theega	1104
	Aristolochia indica	Iswara-theega	1202
Dioscoriaceæ	*Dioscorea esculenta*	Thippa-theega	1510
	Dioscorea hispida	Thelia-ginigedda	1511
	Dioscorea pentaphylla	Adavi-ginusu-theega	1511
Liliaceæ	*Asparagus racemosus*	Pili-theegalu	1517
	Smilax zeylanica	Kummari-theega	1518
	Gloriosa superba	Adavi-nabhi	1519
Palmæ	*Calamus rotang*	Betham	..
Graminæ	*Spinifex squarrosus*	Ravanasurudu-meesalu	..

APPENDIX I (*b*).

LIST OF TREES, SHRUBS AND CLIMBERS IN THE FORESTS OF THE LOWER GODAVARI DIVISION (TELUGU NAMES ARRANGED ALPHABETICALLY).

Vernacular name.	Botanical name.	Natural order.	Page in Flora of the Madras Presidency.
(1)	(2)	(3)	(4)
	A.—Trees.		
Adavi-mamidi	*Spondias mangifera*	Anacardiaceæ	261
Adavi-munaga	*Moringa concanensis*	Moringaceæ	270
Adavi-nimma	*Atalantia monophylla*	Rutaceæ	159
Akasa-malli	*Millingtonia hortensis*	Bignoniaceæ	994
Aku-pala	*Wrightia tinctoria*	Apocynaceæ	815
Alamanda	*Macaranga peltata*	Euphorbiaceæ	1326
Alli	*Memecylon edule*	Melastomaceæ	504
Ambada	*Spondias mangifera*	Anacardiaceæ	261
Anepu	*Bridelia retusa*	Euphorbiaceæ	1280
Ari	*Bauhinia racemosa*	Leguminosæ	406
Atti	*Ficus glomerata*	Moraceæ	1364
Baditha	*Erythrina indica*	Leguminosæ	353
Balli	*Bridelia tomentosa*	Euphorbiaceæ	1281
Bandaru	*Adina cordifolia*	Rubiaceæ	584
Banka-nakkiri	*Cordia obliqua*	Boraginaceæ	887
Barrinki	*Streblus asper*	Moraceæ	1353
Battaganapa	*Mitragyna parvifolia*	Rubiaceæ	585
Bhutankusam	*Elæodendron glaucum*	Celastraceæ	211
Billudu	*Chloroxylon swietenia*	Rutaceæ	152
Bodda-marri	*Fisus hispida*	Moraceæ	1367
Boggu-chettu	*Trema orientalis*	Ulmaceæ	1350
Botruga	*Mitragyna parvifolia*	Rubiaceæ	585
Budda-dudduga	*Saccopetalum tomentosum*	Anonaceæ	22
Buruga	*Bombax malabaricum*	Malvaceæ	99
Busi	*Schleichera trijuga*	Sapindaceæ	248
Chennangi	*Lagerstrœmia parviflora*	Lythraceæ	512
Chikkudu	*Ougenia dalbergioides*	Leguminosæ	340
Chilaka-dudduga	*Polyalthia cerasoides*	Anonaceæ	17
Chilla	*Strychnos potatorum*	Loganiaceæ	868

Vernacular name. (1)	Botanical name. (2)	Natural order. (3)	Page in Flora of the Madras Presidency. (4)
	A.—Trees—cont.		
Chinduga	*Albizzia odoratissima*	Leguminosæ	431
Chinni	*Gymnosporia montana*	Celastraceæ	209
Chinta	*Tamarindus indica*	Leguminosæ	409
Chirimanu	*Anogeissus latifolia*	Combretaceæ	466
Chitrek	*Protium serratum*	Burseraceæ	171
Dadduga	*Adina cordifolia*	Rubiaceæ	584
Devadari	*Erythroxylon monogynum*	Linaceæ	127
Devakanchanamu	*Bauhinia variegata*	Leguminosæ	407
Dirisena	*Albizzia lebbek*	Leguminosæ	432
Divi-divi	*Caesalpinia coriaria*	Leguminosæ	394
Dudippa	*Hymenodictyon excelsum*	Rubiaceæ	589
Erra-juvvi	*Ochna squarrosa*	Ochnaceæ	165
Erraponaku	*Sterculia urens*	Sterculiaceæ	106
Errapurugudu	*Breynia rhamnoides*	Euphorbiaceæ	1304
Gangaravi	*Thespesia populnea*	Malvaceæ	101
Gara	*Balanites roxburghii*	Simarubaceæ	164
Garugudu	*Garuga pinnata*	Burseraceæ	169
Gatha	*Diospyros sylvatica*	Ebenaceæ	773
Cedara	*Ceriops roxburghiana*	Rhizophoraceæ	457
Giruguday	*Casearia tomentosa*	Samydaceæ	521
Goddari	*Bauhinia retusa*	Leguminosæ	407
Gorintha	*Lawsonia inermis*	Lythraceæ	514
Gotti	*Zizyphus xylopyra*	Rhamnaceæ	220
Guggilam	*Aegiceras corniculatum*	Myrsinaceæ	757
Gummadi	*Gmelina arborea*	Verbenaceæ	1097
Gumpena	*Odina wodier*	Anacardiaceæ	263
Gundu-mada	....	Verbenaceæ	..
Illinda	*Diospyros chloroxylon*	Ebenaceæ	776
Indupa	*Strychnos potatorum*	Loganiaceæ	868
Ippa	*Bassia latifolia*	Sapotaceæ	763
Isikarasi	*Stereospermum tetragonum*	Bignoniaceæ	998
Ita	*Phoenix sylvestris*	Palmæ	..
Jammi	*Prosopis spicigera*	Leguminosæ	419
Jeedi-mamidi	*Anacardium occidentale*	Anacardiaceæ	260
Jeeluga	*Caryota urens*	Palmæ	..
Jittegi	*Dalbergia latifolia*	Leguminosæ	383
Juvvi	*Ficus tomentosa*	Moraceæ	1361
Kadem	*Barringtonia acutangula*	Lecythidaceæ	487
Kalinga	*Sonneratia apetala*	Sonneratiaceæ	515
Kanchanamu	*Bauhinia purpurea*	Leguminosæ	407
Kandilla	*Bruguiera cylindrica*	Rhizophoraceæ	459
Kanuga	*Pongamia glabra*	Leguminosæ	385
Karaka	*Terminalia chebula*	Combretaceæ	464
Karinguva	*Gardenia latifolia*	Rubiaceæ	619
Kattimandu	*Euphorbia trigona*	Euphorbiaceæ	1277
Kavva-gummadi	*Gmelina asiatica*	Verbenaceæ	1098
Kodavali	*Dolichandrone falcata*	Bignoniaceæ	996
Kodisa	*Cleistanthus collinus*	Euphorbiaceæ	1282
Konda-gogu	*Cochlospermum gossypium*	Bixaceæ	50
Konda-pothari	*Kydia calycina*	Malavaceæ	83
Konda-thangedu	*Xylia xylocarpa*	Leguminosæ	417
Konda-vepa	*Chukrasia tabularis*	Meliaceæ	186
Koramanu	*Bridelia retusa*	Euphorbiaceæ	1280
Korivipala	*Ixora parviflora*	Rubiaceæ	631
Kumbhi	*Careya arborea*	Lecythidaceæ	488
Kummaraponaku	*Sterculia villosa*	Sterculiaceæ	106
Kunkudu	*Sapindus emarginatus*	Sapindaceæ	250
Kuntichinta	*Pleurostylia wightii*	Celastraceæ	211
Loluga	*Pterospermum suberifolium*	Sterculiaceæ	109
Maddi	*Terminalia tomentosa*	Combretaceæ	465
Mamidi	*Mangifera indica*	Anacardiaæ	259
Manchi-bikki	*Gardenia gummifera*	Rubiaceæ	618
Maredu	*Aegle marmelos*	Rutaceæ	161
Marri	*Ficus bengalensis*	Moraceæ	361
Moduga	*Erythrina suberosa*	Leguminosæ	354
Moduga	*Butea frondosa*	Leguminosæ	357
Mogali	*Pandanus tectorius*	Pandanaceæ	..
Mokkam	*Schrebera swietenioides*	Oleaceæ	792
Mollem	*Bambusa arundinacea*	Gramineæ	..
Mullu-modugu	*Erythrina suberosa*	Leguminosæ	354
Munnuti-karaka	*Melia composita*	Meliaceæ	176
Musti	*Strychnos nux-vomica*	Loganiaceæ	868
Nagalla-pachari	*Dalbergia lanceolaria*	Leguminosæ	383
Nalla-jeedi	*Semecarpus anacardium*	Anacardiaceæ	266
Nalla-mada	*Avicennia officinalis*	Verbenaceæ	1105
Nalla-maddi	*Terminalia tomentosa*	Combretaceæ	465
Nalla-manga	*Randia uliginosa*	Rubiaceæ	615
Nalla-regu	*Albizzia amara*	Leguminosæ	432
Nalla-thumma	*Acacia arabica*	Leguminosæ	425
Naramamidi	*Litsea chinensis*	Lauraceæ	1235
Navuru	*Premna tomentosa*	Verbenaceæ	1095
Neeralli	*Plectronia didyma*	Rubiaceæ	624
Neeredu	*Syzygium jambolanum*	Myrtaceæ	481
Nemali	*Holoptelea integrifolia*	Ulmaceæ	1348

Vernacular name. (1)	Botanical name. (2)	Natural order. (3)	Page in Flora of the Madras Presidency. (4)
	A. Trees—cont.		
Nemali-adugu	*Vitex altissima*	Verbenaceæ	1102
Nidara-ganneru	*Enterolobium saman*	Leguminosæ	435
Nimma	*Citrus medica*	Rutaceæ	161
Pacha-ganneru	*Thevetia neriifolia*	Apocynaceæ	821
Pala	*Mimusops hexandra*	Sapotaceæ	766
Pala	*Holarrhena antidysenterica*	Apocynaceæ	811
Pampini	*Oroxylum indicum*	Bignoniaceæ	994
Panasa	*Artocarpus integrifolia*	Moraceæ	1369
Pandi-jaruga	*Buchanania lanceolata*	Anacardiaceæ	259
Pantangi	*Bridelia montana*	Euphorbiaceæ	1281
Parivili	*Tamarix gallica*	Tamaricaceæ	67
Pasi	*Anogeissus acuminata*	Combretaceœ	467
Peda-chilaka-dudduga	*Miliusa velutina*	Anonaceœ	21
Peda-kalinga	*Sonneratia alba*	Sonneratiaceæ	..
Pedda-bikki	*Gardenia latifolia*	Rubiaceæ	619
Peddamanu	*Ailanthus excelsa*	Simarubaceæ	163
Peddari	*Bauhinia purpurea*	Leguminosæ	407
Bisiniki	*Maba buxifolia*	Ebenaceæ	768
Pitta-juvvi	*Ficus tsiela*	Moraceæ	1362
Pogada	*Michelia champaca*	Magnoliaceæ	9
Pogada	*Mimusops elengi*	Sapotaceæ	765
Pogada	*Nyctanthes arbortristis*	Oleaceæ	792
Porla-pachari	*Dalbergia paniculata*	Leguminosæ	383
Pullari	*Antidesma ghaesembilla*	Euphorbiacæ	1298
Puthika-thada	*Flacourtia ramontchi*	Bixaceæ	54
Ravi	*Ficus religiosa*	Moraceæ	1363
Regu	*Zizyphus jujuba*	Rhamnaceæ	219
Rella	*Cassia fistula*	Leguminosæ	400
Revadi	*Dillenia pentagyna*	Dilleniaceæ	8
Rudraksha	*Guazuma tomentosa*	Sterculiaceæ	111
Sadanam	*Dendrocalamus strictus*	Gramineæ	..
Sara	*Buchanania lanzan*	Anacardiaceæ	258
Sarugudu	*Casuarina equisetifolia*	Casuarinaceæ	1389
Senuga	*Xylocarpus obovatus*	Meliaceæ	185
Sima-chinta	*Pithecolobium dulce*	Leguminosæ	434
Sithaphalam	*Anona squamosa*	Anonaceæ	20
Somi	*Soymida febrifuga*	Meliaceæ	185
Sundra	*Acacia sundra*	Leguminosæ	428
Teku	*Tectona grandis*	Verbenaceæ	1092
Thada	*Pterospermum heyneanum*	Sterculiaceæ	108
Thada	*Grewia tiliæfolia*	Tiliaceæ	118
Thadi	*Borassus flabellifer*	Palmæ	..
Thadi	*Terminalia belerica*	Combretaceæ	463
Thanduga	*Lumnitzera racemosa*	Combretaceæ	468
Thanuku	*Gyrocarpus americanus*	Hernandiaceæ	1242
Thapasi	*Sterculia urens*	Sterculiaceæ	106
Thedlapala	*Wrightia tomentosa*	Apocynaceæ	816
Thella-chinduga	*Albizzia procera*	Leguminosæ	431
Thella-mada	*Avicennia marina*	Verbenaceæ	1106
Thella-maddi	*Terminalia arjuna*	Combretaceæ	465
Thella-poliki	*Givotia rottleriformis*	Euphorbiaceæ	1342
Thella-purugudu	*Fluggia virosa*	Euphorbiaceæ	1296
Thella-thumma	*Acacia leucophlœa*	Leguminosæ	427
Thogaru	*Morinda tinctoria*	Rubiaceæ	651
Thorrivelaga	*Limonia crenulata*	Rutaceæ	157
Thumiki	*Diospyros melanoxylon*	Ebenaceæ	772
Thuraka-vepa	*Melia azedarach*	Meliaceæ	176
Tilla	*Excoecaria agallocha*	Euphorbiaceæ	1344
Uduga	*Alangium salvifolium*	Alangiaceæ	572
Uppu-ponna	*Rhizophora mucronata*	Rhizophoraceæ	456
Uppu-ponna	*Rhizophora candelaria*	Rhizophoraceæ	456
Urudu	*Bruguiera conjugata*	Rhizophoraceæ	458
Usirika	*Emblica officinalis*	Euphorbiaceæ	1295
Vanna-sundra	*Acacia ferruginea*	Leguminosæ	428
Vasantagunda	*Mallotus philippinensis*	Euphorbiaceæ	1322
Vata-narayana	*Delonix elata*	Leguminosæ	396
Vavili	*Vitex negundo*	Verbenaceæ	1102
Velaga	*Feronia elephantum*	Rutaceæ	160
Velthuru	*Dichrostachys cinerea*	Leguminosæ	419
Vepa	*Azadirachta indica*	Meliaceæ	177
Vilava-mada	*Avicennia alba*	Verbenaceæ	1106
Viruguduchava	*Dalbergia latifolia*	Leguminosæ	383
Vulimidi	*Crataeva religiosa*	Capparidaceæ	47
Yegisi	*Pterocarpus marsupium*	Leguminosæ	385
Yepi	*Hardwickia binata*	Leguminosæ	412
Yerra-gatha	*Diospyros montana*	Ebenaceæ	776
Yerra-juvvi	*Ficus retusa*	Moraceæ	1362
Yerri-bikki	*Gardenia lucida*	Rubiaceæ	618
Yeti-maddi	*Terminalia arjuna*	Combretaceæ	465
	B.—Shrubs.		
Adavi-chamanti	*Helicteres isora*	Sterculiaceæ	107
Adavi-mayuram	*Ardisia solanacea*	Myrsinaceæ	756
Adavi-pasupu	*Zingiber casumunar*	Zingiberaceæ	1490
Addasaram	*Adhatoda vasica*	Acanthaceæ	1082

Vernacular name. (1)	Botanical name. (2)	Natural order. (3)	Page in Flora of the Madras Presidency. (4)
	B. Shrubs—cont.		
Alchi	*Acanthus ilicifolius*	Acanthaceæ	1014
Balusu	*Plectronia parviflora*	Rubiaceæ	625
Bandedu	*Dodonea viscosa*	Sapindaceæ	253
Chillanki	*Dalbergia spinosa*	Leguminosæ	381
Chitramulam	*Plumbago zeylanica*	Plumbaginaceæ	744
Chitteetha	*Phœnix humilis*	Palmæ	..
Chitteetha	*Phœnix acaulis*	Palmæ	..
Chitti-jana	*Grewia hirsuta*	Tiliaceæ	119
Edakula-pala	*Alstonia scholaris*	Apocynaceæ	810
Golugu	*Glycosmis cochinchinensis*	Rutaceæ	153
Ilakura	*Suœda monoica*	Chenopodiaceæ	1184
Ilakura	*Suœda maritima*	Chenopodiaceæ	1184
Jana	*Grewia rothii*	Tiliaceæ	118
Jeeluga	*Aeschynomene aspera*	Leguminosæ	331
Jilludu	*Calotropis gigantea*	Asclepiadaceæ	832
Karubenda	*Pavonia zeylanica*	Malvaceæ	83
Karuvepaku	*Murraya konigii*	Rutaceæ	156
Kasinda	*Cassia occidentalis*	Leguminosæ	401
Kithanara	*Alœ vera*	Liliaceæ	1520
Kommu-papidi	*Chomelia asiatica*	Rubiaceæ	613
Konda-kasintha	*Toddalia asiatica*	Rutaceæ	150
Kondantitha	*Desmodium pulchellum*	Leguminosæ	344
Konda-vempali	*Indigofera parviflora*	Leguminosæ	311
Krishna-tulasi	*Ocimum sanctum*	Labiatæ	1111
Manga	*Randia dumetorum*	Rubiaceæ	615
Naga-golugu	*Murraya exotica*	Rutaceæ	155
Nakkiri	*Ximenia americana*	Olacaceæ	189
Nalla-purugudu	*Kirganelia reticulata*	Euphorbiaceæ	1294
Nalla-vuppi	*Capparis sepiaria*	Capparidaceæ	46
Nela-vakudu	*Solanum xanthocarpum*	Solanaceæ	938
Papidi	*Pavetta indica*	Rubiaceæ	633
Pedda-nepalam	*Jatropha curcas*	Euphorbiaceæ	1340
Pisingi	*Clerodendron inerme*	Verbenaceæ	1099
Rama-tulasi	*Ocimum gratissimum*	Labiatæ	1111
Seema-neepalam	*Croton lawianus*	Euphorbiaceæ	1315
Sugandhi-pala	*Hemidesmus indicus*	Asclepiadaceæ	825
Thangedu	*Cassia auriculata*	Leguminosæ	402
Thantepu	*Cassia tora*	Leguminosæ	401
Vaka	*Carissa spinarum*	Apocynaceæ	805
Vempali	*Tephrosia purpurea*	Leguminosæ	320
Vuchinta	*Solanum trillobatum*	Solanaceæ	938
Vummetta	*Datura stramonium*	Solanaceæ	941
Yerra-chitramulam	*Plumbago rosea*	Plumbaginaceæ	745
	C. Climbers.		
Adavi-chemma	*Canavalia virosa*	Leguminosaæ	359
Adavi-draksha	*Ampelocissus latifolia*	Vitaceæ	230
Adavi-ginusu-theega	*Dioscerea pentaphylla*	Dioscoriaceæ	1511
Adavi-malli	*Jasminum arborescens*	**Oleacea**	789
Adavi-nabhi	*Gloriosa superba*	Liliaceæ	1519
Adda-theega	*Bauhinia vahlii*	Leguminosæ	408
Bandi-guruvenda	*Abrus pulchellus*	Leguminosæ	350
Bankaboddu	*Cissus vitiginea*	Vitacea	234
Betham	*Calamus rotang*	Palmæ	..
Bontha-theega	*Combretum decandrum*	Combretaceæ	468
Chevulapilli-theega	*Ipomaea pes-caprae*	Convolvulaceæ	917
Dustapu-teega	*Pergularia extensa*	Asclepiadaceæ	837
Enugu-dulagunda	*Mucuna prurita*	Leguminosæ	356
Erra-chirathali	*Ventilago calyculatta*	Rhamnaceæ	218
Gecha	*Cœsalpinia crista*	Leguminosæ	393
Guruvenda	*Abrus precatorius*	Leguminosæ	349
Iswara-theega	*Aristolochia indica*	Aristolochiaceæ	1202
Kodimudusu	*Pterolobium indicum*	Leguminosæ	395
Korintha	*Acacia cæsia*	Leguminosæ	428
Kummari-theega	*Smilax zeylanica*	Liliaceæ	1518
Moduga-theega	*Spatholobus roxburghii*	Leguminosæ	358
Mukkuthummudu-theega	*Leptadenia reticulata*	Asclepiadaceæ	850
Naguru-theega	*Symphorema involucratum*	Verbinaceæ	1104
Nallaboddu	*Cissus repens*	Vitaceæ	233
Nalla-theega	*Derris uliginosa*	Leguminosæ	387
Nalla-theega	*Derris scandens*	Leguminosæ	387
Nalleru	*Cissus quadrangularis*	Vitaceæ	233
Palasamudra-theega	*Argyrea speciosa*	Convolvulaceæ	907
Palatheega	*Ichnocarpus frutescens*	Apocynaceæ	820
Pariki	*Zizyphus œnoplia*	Rhamnaceæ	220
Pilli-theegalu	*Asparagus racemosus*	Liliaceæ	1517
Pippinda-teega	*Calycopteris floribunda*	Combretaceæ	467
Ravanasurudu-meesalu	*Spinifex squarrosus*	Gramineæ	..
Seethamma-savaram	*Cuscuta reflexa*	Convolvulaceæ	931
Sheekayi	*Acacia concinna*	Leguminosæ	429
Theega-moduga	*Butea superba*	Leguminosæ	358
Theegi-nakkiri	*Olax scandens*	Olacaceæ	190
Thella-ginigedda	*Dioscorea hispida*	Dioscoriaceæ	1511
Thippa-theega	*Dioscorea esculenta*	Dioscoriaceæ	1510
Ungarala-pedem	*Hugonia mystax*	Linaceæ	126
Vedala-theega	*Combretum ovalifolium*	Combretaceæ	469

APPENDIX II.

GLOSSARY OF VERNACULAR TERMS.

I. *Topographical.*

Balthi	Blank.
Bandi-dari	Cart-track.
Chadunu or Chaduru	Plateau.
Cheedu	Salt-water creek.
Cheruvu	Tank.
Chilapa	Feeder stream.
Chilapa-adivi	Scrub jungle.
Digudu	Descent.
Dona	Cave.
Ekkudu	Ascent.
Gandi	Saddle.
Godlu-dari or Godla-puntha	Cattle path.
Guha	Cave.
Gutta	Hillock.
Jala	Spring.
Kalava	Main stream.
Kali-dari or Kali-throva	Foot path.
Karavaka	Seashore.
Konda	Hill.
Kunta	Small tank.
Lanka	Alluvial terrace with good growth.
Loddi	Valley.
Lopali-batalu	Interior lines.
Metta	Hillock.
Moga	Mouth of a creek.
Nadi	River.
Oota	Spring.
Parra	Back-water.
Parvathamu	Hill.
Patu	Ebb of the tide.
Pedda-adavi	Timber forest.
Pedda-bata or Pedda-puntha	Reserve boundary.
Potu	Flow of the tide.
Risanu	Reserve.
Salu	Range of hills.
Sikharam	Peak.
Vagu	Main stream.
Varrelu	Broken ground.
Yeru	Salt-water creek.

II. *Forest Produce.*

Abbrakamu	Mica.
Baditha	Short lengths of timber below 18″ in girth.
Bazu	Timber 18″ to 24″ in girth.
Bana karralu	Lathies of *Dendrocalamus strictus*: 240 go to a cart-load.
Baru veduru	*Bambusa arundinacea* and *Dendrocalamus strictus* of medium thickness used mainly for house-building. 180 go to a cart-load.
Boggu	Charcoal.
Charmamulu	Skins.
Chintapandu	Tamarind.
Chituku	Brush-wood.
Dulam	Timber, 24″ to 36″ in girth.
Gaddi-chekku	Turf.
Gaddi-nulaka	Grass rope.
Indupukayalu	Clearing nuts.
Jeedi ginjalu	Marking nuts.
Karakkayalu	Myrabolams.
Karra	Timber 36″ to 48″ in girth.
Kavadi-baddalu	Shoulder shafts of *Bambusa arundinacea* split in two. 240 go to a cart-load.

II. Forest Produce—cont.

Kommulu	Horns.
Kunkudu-kayalu	Soap-nuts.
Mudara-veduru	Thick, fairly even-grown, *Dendrocalamus strictus* between 2 and 3 years old. Outer skin should not be damaged. 140 go to a cart-load.
Modati-potu-vasam	Thin to medium size *Dendrocalamus strictus* cut low with bottom usually solid or nearly so. Mainly used for sugar-cane props and plantain tree props; and to some extent for house building. 300 go to a cart-load.
Mollem	*Bambusa arundinacea*
Mollem kanathi	Lower lengths of *Bambusa arundinacea* above 6″ in girth used for house-building. 140 go to a cart-load.
Mulakala karralu	Thin sticks of *Dendrocalamus strictus* usually used by cultivators for driving cattle. 1,200 go to a cart-load.
Mynam	Bees wax.
Nichena-gedalu	Thick full length bamboos of *Dendrocalamus strictus* used for ladders. 140 go to a cart-load.
Palaka	Timber 48″ and above in girth.
Sadanam	*Dendrocalamus strictus.*
Sadanam kanathi	Lower lengths of *Dendrocalamus strictus* usually above 6″ in girth used mainly for house building. 140 go to a cart-load.
Thati-akulu	Palmyra leaves.
Theni	Honey.
Thotha-gedalu	Thick full length bamboos of *Dendrocalamus strictus* usually used for poling boats. 140 go to a cart-load.
Vanta-cheruku	Fire-wood.
Vasam	Timber below 18″ in girth.

III. Shikar.

Adavi-pandi	Boar, Pig.
Chinduga or Chiruta-puli	Panther.
Dummulagondu	Hyena.
Duppi	Chital.
Gora-gedi	Bison.
Kanusu	Sambhur.
Konda-gorri	Muntjac.
Manubothu	Nilgai.
Pandi	Boar, Pig.
Pedda-puli	Tiger.
Rechu-kukka	Wild-dog.
Yelugu-banti	Bear.

IV. General.

Bandi-baruvu	Cart-load.
Bhavi	Well.
Chepala-veta	Fishing.
Doni	Sea-going fishing boat.
Garapa-bhumi	Loamy soil.
Gatti-nela	Hard ground.
Isuka bhumi	Sandy soil.
Jamindari adavi	Estate forest.
Kadi-baruvu	Yoke load.
Kanakara-neela or Kankara-bhumi.	Kankar soil.
Kavadi-baruvu	Two head-loads.
Koya-gudem	Koya village.
Lothu	Deep.
Meraka	Shallow.
Nalla-regadi or Nalla-revadi	Black-cotton soil.
Nava	Open boat.
Netti-baruvu	Head-load.
Nuyyi	Well.
Paka	Shed.
Rathi-bhumi	Stony soil.
Regadi-bhumi or Revadi-bhumi	Clayey soil.
Theddu	Oar.
Vala	Net.

APPENDIX III (*a*).

RAINFALL AT REVENUE STATIONS, LOWER GODAVARI DIVISION, FOR 1923 TO 1932.

Year.	Month.																								Whole year.	
	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.			
	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)
COCANADA.																										
1923	..	0·02	3	1·33	..	..	..	0·02	3	0·58	2	0·78	9	5·28	10	4·83	16	8·47	9	13·34	5	17·79	..	..	57	52·44
1924	1	0·16	..	..	..	..	..	..	3	1·64	4	1·13	9	4·52	11	8·76	14	15·52	5	5·40	10	16·47	..	..	57	53·60
1925	..	0·06	..	..	1	0·40	..	0·07	5	5·49	10	7·48	15	12·83	10	3·83	9	5·85	10	13·71	4	4·62	1	0·18	65	54·52
1926	1	0·26	..	0·02	4	4·35	2	2·20	1	0·99	5	2·86	16	17·23	13	7·21	6	4·26	5	4·26	..	..	..	..	53	43·64
1927	4	3·21	..	..	..	0·06	..	..	1	0·28	13	5·47	11	7·33	11	4·53	15	7·29	4	2·59	8	9·25	..	..	67	40·01
1928	..	..	..	0·01	..	..	3	1·12	2	0·58	5	1·59	13	6·69	4	1·19	13	8·60	14	13·80	..	0·09	..	0·03	54	33·70
1929	..	..	..	0·05	..	..	2	0·41	..	0·16	13	10·20	10	5·00	7	2·82	10	7·07	7	6·97	1	0·25	3	3·22	53	36·15
1930	..	..	..	0·05	..	0·01	..	..	7	6·30	14	6·73	6	2·54	8	3·17	7	4·43	15	22·30	8	10·96	..	0·09	65	56·58
1931	..	..	..	..	..	..	..	0·01	2	1·37	5	4·21	12	9·40	14	6·54	11	9·80	15	15·99	5	8·13	..	..	64	55·45
1932	..	..	3	0·54	..	..	..	0·05	2	1·08	8	3·31	18	9·25	6	4·78	9	3·92	9	6·88	8	7·45	..	..	63	37·26
Average ..	1	0·37	1	0·20	1	0·48	1	0·39	3	1·85	8	4·38	12	8·01	9	4·77	11	7·52	9	10·52	5	7·50	..	0·35	60	46·34
RAJAHMUNDRY.																										
1923	..	..	5	1·09	1	0·20	1	0·69	2	0·80	2	1·12	10	8·85	12	3·29	16	14·21	4	8·53	5	6·71	..	..	58	45·49
1924	..	..	..	..	..	..	..	..	3	3·55	5	3·11	9	6·19	13	6·55	17	13·91	7	5·29	9	8·94	..	..	63	47·54
1925	..	..	..	..	..	..	1	0·17	4	4·14	8	4·25	15	10·93	16	7·47	8	4·42	8	6·98	2	2·23	..	..	62	40·59
1926	1	0·13	1	0·20	2	2·55	2	1·59	5	4·50	3	5·24	14	10·03	12	4·89	6	3·05	4	2·17	..	..	..	..	50	34·35
1927	..	0·03	1	0·33	..	..	..	..	4	1·69	9	5·07	12	8·32	13	5·49	14	6·67	5	2·16	4	6·30	..	..	62	36·06
1928	..	..	..	..	..	..	2	0·89	1	1·57	3	3·00	12	10·78	6	2·55	8	3·70	15	13·26	1	0·23	..	..	48	35·98
1929	1	0·28	..	..	..	..	1	0·18	2	0·44	7	5·43	6	3·37	5	3·97	7	4·21	5	5·14	1	0·38	2	2·73	37	26·13
1930	..	..	2	0·35	..	..	1	0·90	4	3·10	13	11·81	8	2·52	9	3·64	9	5·08	13	7·06	2	2·63	1	0·14	62	37·23
1931	..	..	..	..	..	..	..	..	4	1·96	7	2·28	14	11·74	17	9·30	14	7·77	14	8·71	2	2·58	..	..	72	44·34
1932	..	..	4	1·78	..	..	2	2·51	1	0·47	8	5·23	17	13·31	10	5·65	11	7·70	3	3·23	10	6·60	..	..	66	46·48
Average ..	..	0·04	1	0·38	..	0·28	1	0·69	8	2·22	7	4·65	12	8·60	11	5·28	11	7·07	8	6·25	4	3·66	..	0·29	58	39·42
POLAVARAM.																										
1923	..	..	4	0·40	3	0·69	..	..	4	1·74	1	1·45	12	12·55	7	2·97	15	17·25	7	13·63	5	5·22	..	..	58	55·90
1924	..	..	..	..	..	..	..	..	4	1·59	4	1·16	13	8·07	14	7·91	16	11·95	6	4·71	10	7·11	..	..	67	42·50
1925	..	..	..	..	2	0·61	4	3·41	7	7·81	8	6·96	16	17·33	19	10·05	8	6·61	7	6·86	2	0·83	..	..	73	60·47
1926	1	0·31	..	..	3	1·88	2	0·36	4	1·45	5	4·03	18	18·40	16	7·11	10	3·33	5	2·86	..	..	..	0·07	64	39·80
1927	..	0·06	..	..	1	2·80	..	..	5	2·81	12	7·84	6	5·59	15	8·20	10	6·77	5	1·90	5	5·61	..	..	59	41·58
1928	..	..	..	..	..	..	6	2·63	..	..	8	5·47	15	12·92	8	4·46	12	4·97	12	8·66	1	0·55	..	..	62	39·66
1929	..	..	..	..	2	1·09	2	0·50	2	0·78	11	7·61	7	2·47	10	3·02	8	5·93	7	6·25	1	1·00	..	0·09	50	28·74
1930	..	..	..	..	..	..	1	0·50	2	1·77	14	15·04	8	2·70	10	5·68	9	4·76	12	5·72	4	5·18	1	0·77	61	42·12
1931	..	..	..	..	..	..	4	2·48	4	1·44	7	5·69	18	11·10	18	11·20	10	8·25	19	10·18	3	3·71	..	..	83	54·05
1932	..	..	5	1·66	..	..	2	1·37	4	1·21	11	7·83	19	13·52	11	5·99	15	10·86	4	1·50	12	8·12	..	..	83	52·06
Average ..	..	0·04	1	0·21	1	0·71	2	1·13	..	2·06	8	6·31	13	10·47	13	6·66	11	8·07	8	6·23	4	3·73	..	0·09	66	45·69
YELLAVARAM.																										
1923	..	..	7	4·13	4	2·13	1	0·32	7	2·26	2	1·94	13	5·45	9	3·41	15	12·33	6	10·11	7	8·36	..	..	71	50·44
1924	..	..	..	..	..	..	4	2·40	6	2·64	4	2·90	17	10·92	11	9·00	14	15·52	5	9·81	4	4·90	..	..	65	58·09
1925	..	..	..	..	..	..	2	0·98	7	8·37	11	11·71	18	15·70	11	6·42	9	6·44	8	3·89	2	0·86	..	..	68	54·37
1926	1	0·15	..	..	4	3·59	4	2·73	3	2·26	5	2·47	13	17·49	6	6·54	8	6·72	4	4·30	..	..	..	..	48	46·25
1927	..	..	1	0·12	2	4·21	3	1·67	5	3·12	11	8·50	16	8·84	16	9·92	13	9·06	8	4·16	4	6·22	..	..	79	55·82
1928	..	..	..	..	..	..	3	1·09	3	2·79	12	7·95	20	15·27	4	1·42	15	8·15	15	14·35	1	0·36	..	..	73	51·38
1929	..	..	2	1·11	..	..	2	0·96	3	2·48	10	10·69	14	7·00	9	5·64	11	4·66	6	5·85	..	..	..	..	57	38·39
1930	..	..	3	2·05	2	2·55	1	0·30	5	3·37	6	10·13	7	3·30	10	4·57	5	5·42	10	7·55	6	5·53	..	..	55	44·77
1931	..	..	..	..	..	..	..	..	3	1·09	5	5·25	14	10·33	13	2·20	12	10·02	19	20·76	2	2·80	..	..	68	62·45
1932	..	..	3	1·93	..	..	5	0·86	2	1·10	2	1·68	15	10·28	12	7·93	13	13·92	7	6·17	8	6·32	..	..	67	50·19
Average ..	..	0·02	2	0·93	1	1·25	3	1·13	4	2·95	7	6·32	15	10·46	10	6·71	12	9·22	9	8·70	3	3·54	..	..	65	51·22

APPENDIX III (*a*)—*cont.*

RAINFALL AT REVENUE STATIONS, LOWER GODAVARI DIVISION, FOR 1923 TO 1932—*cont.*

Year.	Month.																								Whole year.	
	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.			
	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.	Days.	Inches.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)
											BHIMAVARAM.															
1923	..	..	5	1·82	1	0·20	..	..	1	0·13	..	0·05	8	8·00	6	2·85	13	11·03	9	6·77	4	8·45	..	..	47	39·30
1924	..	..	..	..	..	..	..	..	..	..	3	1·27	15	6·80	10	6·09	11	9·68	5	2·48	5	4·76	..	..	49	31·08
1925	..	..	..	..	..	..	2	0·38	5	5·20	9	4·11	18	11·88	10	8·18	4	2·74	11	10·24	3	1·03	1	0·32	63	44·08
1926	1	0·25	1	0·23	2	2·19	1	0·20	2	1·12	3	0·47	12	11·88	14	7·81	6	3·33	2	1·55	..	..	..	..	44	29·03
1927	1	2·40	..	..	..	..	..	..	2	0·65	10	8·24	14	11·26	12	8·56	2	1·77	2	2·40	6	7·35	..	..	49	42·63
1928	..	..	1	1·12	..	0·01	1	0·30	3	2·77	5	1·75	15	7·35	6	1·83	10	10·24	14	10·90	..	..	..	..	55	36·27
1929	..	..	2	0·29	..	..	1	0·22	..	..	11	12·16	11	4·63	10	4·71	10	7·71	7	6·08	..	..	4	2·53	56	38·33
1930	..	..	1	0·96	1	0·56	..	..	5	2·55	12	7·81	8	3·66	11	5·45	6	6·84	13	13·09	4	4·36	2	0·85	63	46·13
1931	..	..	..	..	..	..	..	..	..	0·04	7	5·36	18	12·71	16	6·72	12	8·74	12	9·92	8	9·11	..	0·03	73	52·63
1932	..	..	..	..	..	..	2	0·52	3	2·89	7	3·22	14	10·16	11	6·77	7	6·32	7	4·96	8	5·90	..	..	59	40·74
Average ..	**..**	**0·27**	**1**	**0·44**	**..**	**0·30**	**1**	**0·16**	**2**	**1·54**	**7**	**4·44**	**13**	**8·83**	**11**	**5·90**	**8**	**6·84**	**8**	**6·84**	**4**	**4·10**	**1**	**0·37**	**56**	**40·02**
											CORINGA.															
1923	..	..	2	0·44	..	0·02	..	..	1	0·12	1	1·38	5	5·77	7	3·15	10	10·27	7	13·79	4	13·18	..	..	37	48·12
1924	1	0·45	..	..	..	..	..	..	3	3·23	2	1·75	11	5·69	8	7·57	14	17·68	7	7·00	8	21·17	..	..	54	64·54
1925	..	..	..	..	..	..	..	..	5	7·39	7	4·87	11	9·35	11	2·89	9	5·26	10	14·97	7	4·49	1	0·18	61	49·40
1926	3	1·06	..	..	2	2·61	1	1·12	2	1·54	4	1·57	16	20·48	9	7·15	9	3·54	7	4·03	..	..	..	..	53	43·10
1927	3	1·46	..	..	..	..	..	..	2	0·34	9	9·78	10	8·50	13	6·34	10	6·06	7	2·83	6	6·29	..	..	60	41·60
1928	..	..	..	..	..	..	3	1·05	3	1·14	2	1·43	16	11·17	5	2·29	6	9·28	13	14·58	..	..	..	0·08	48	41·02
1929	..	..	..	..	..	..	..	0·03	1	0·95	10	8·94	12	3·95	5	1·57	13	8·83	8	8·30	2	1·14	2	1·88	53	35·59
1930	..	..	3	0·54	..	..	..	..	5	9·76	13	10·42	7	2·23	10	6·26	6	4·40	15	21·69	6	9·80	1	0·22	66	65·32
1931	..	..	..	..	..	..	..	..	4	0·99	5	1·58	11	7·47	13	5·92	12	6·99	18	11·51	6	11·60	..	..	69	46·06
1932	..	..	2	3·11	..	..	..	..	..	..	*	*	*	*	*	*	*	*	*	*	*	*	*	*	2	3·11
Average ..	**1**	**0·30**	**1**	**0·41**	**..**	**0·26**	**..**	**0·22**	**3**	**2·55**	**6**	**4·64**	**11**	**8·29**	**9**	**4·79**	**10**	**8·03**	**10**	**10·97**	**4**	**7·52**	**..**	**0·26**	**55**	**48·24**

* * Abolished.

APPENDIX III (*b*).

RAINFALL AT FOREST STATIONS, LOWER GODAVARI DIVISION, FOR 1923 TO 1932.

Year.	Month.												Whole year.
(1)	January. (2)	February. (3)	March. (4)	April. (5)	May. (6)	June. (7)	July. (8)	August. (9)	September. (10)	October. (11)	November. (12)	December. (13)	(14)
	INCHES.	INCHES.	INCHES.	INCHES.	INCHES.	INCHES.	INCHES.	INCHES.	INCHES.	INCHES.	INCHES.	INCHES.	INCHES.
						SUDIKONDA.							
1923	..	..	..	..	..	..	..	..	..	2·00	16·00	0·20	18·20
1924	..	..	..	..	1·20	0·40	4·20	4·60	4·80	8·20	4·00	1·00	28·40
1925	..	..	..	..	6·00	2·40	12·00	3·60	3·60	3·60	0·80	..	32·00
1926	..	..	1·20	..	..	1·20	10·00	6·40	16·40	..	..	..	35·20
1927	..	..	5·40	..	..	12·20	13·50	4·20	2·80	1·20	0·20	..	39·50
1928	..	..	..	2·00	1·20	2·20	5·50	0·80	7·20	4·40	1·00	..	24·30
1929	..	..	..	..	..	4·20	1·60	2·60	5·60	6·40	..	..	20·40
1930	..	3·20	0·04	0·60	2·70	11·60	2·60	5·20	8·80	6·40	5·00	..	46·14
1931	..	..	..	0·80	2·00	3·20	9·60	3·20	8·80	10·00	2·00	..	39·60
1932	..	3·60	..	1·20	..	2·00	2·00	4·40	6·00	0·80	9·60	..	29·60
Average	..	**0·68**	**0·66**	**0·46**	**1·31**	**3·94**	**6·10**	**3·50**	**6·40**	**4·30**	**3·86**	**0·12**	**31·33**
						YELLESHWARAM.							
1923	..	..	1·40	2·50	..	3·00	5·50	6·50	8·00	8·25	16·05	..	51·20
1924	..	..	..	..	1·80	2·00	15·80	12·00	11·25	8·50	9·50	..	60·85
1925	..	..	..	1·70	11·20	6·50	16·80	10·75	6·40	7·40	0·40	..	61·15
1926	..	..	2·70	3·40	4·55	2·42	11·65	5·19	7·69	1·67	..	..	39·27
1927	..	..	2·88	..	3·06	3·88	5·69	3·49	5·74	1·24	7·26	..	33·24
1928	..	..	..	3·95	0·50	3·93	10·36	..	7·90	11·44	..	..	38·08
1929	..	..	..	0·45	..	6·37	4·60	2·36	9·00	7·49	..	..	30·27
1930	..	4·39	0·18	2·19	3·07	7·70	2·78	2·14	5·06	8·41	6·86	..	42·78
1931	..	..	..	0·19	..	7·30	14·25	6·88	7·62	13·79	3·00	..	53·03
1932	..	3·50	0·55	0·62	0·42	3·00	6·96	5·11	7·28	2·51	4·45	..	34·40
Average	—	**0·79**	**0·77**	**1·50**	**2·46**	**4·61**	**9·44**	**5·44**	**7·59**	**7·07**	**4·75**	..	**44·43**
						RAJAVOMMANGI.							
1923	..	4·50	3·50	1·50	4·00	0·50	4·50	3·75	9·80	2·50	13·00	..	47·55
1924	..	..	..	2·00	2·00	2·00	10·00	18·60	15·00	6·00	3·70	..	59·30
1925	..	..	..	5·50	9·50	10·50	15·00	10·00	4·00	6·00	2·00	1·50	64·00
1926	..	..	2·80	3·60	..	3·60	10·40	3·44	6·80	4·80	..	..	35·44
1927	..	..	1·60	..	3·60	14·80	9·60	6·40	5·00	2·40	7·20	..	50·60
1928	..	..	..	2·90	3·10	6·20	9·60	2·00	5·80	12·00	2·00	..	43·60
1929	..	4·40	..	1·60	..	6·00	2·80	4·50	9·20	5·30	..	..	33·80
1930	..	2·30	..	3·70	2·40	2·20	5·60	0·80	2·80	2·60	4·00	..	26·40
1931	..	..	..	3·20	2·00	3·60	6·80	1·60	11·60	20·80	4·00	..	53·60
1932	..	2·00	..	0·80	0·80	0·80	6·40	4·00	6·00	7·40	9·00	..	37·20
Average	..	**1·32**	**0·79**	**2·48**	**2·74**	**5·02**	**8·07**	**5·51**	**7·60**	**6·98**	**4·49**	**0·15**	**45·15**

APPENDIX III (*b*)—*cont.*

RAINFALL AT FOREST STATIONS, LOWER GODAVARI DIVISION, FOR 1923 TO 1932—*cont.*

Year.	Month.												Whole year.
(1)	January. (2) INCHES.	February. (3) INCHES.	March. (4) INCHES.	April. (5) INCHES.	May. (6) INCHES.	June. (7) INCHES.	July. (8) INCHES.	August. (9) INCHES.	September. (10) INCHES.	October. (11) INCHES.	November. (12) INCHES.	December. (13) INCHES.	(14) INCHES.
						LODODDI.							
1923	..	1·60	..	2·00	3·60	2·00	4·00	4·00	6·00	..	20·00	..	43·20
1924	..	..	..	2·80	2·00	3·00	2·00	8·00	4·00	6·80	2·00	..	30·60
1925	..	..	..	2·00	12·00	12·00	18·20	5·80	5·40	4·40	..	..	59·80
1926	..	..	3·13	3·54	0·80	4·80	6·00	10·40	9·90	7·00	..	..	45·57
1927	..	..	0·80	..	7·40	10·60	4·00	7·50	5·00	2·00	6·60	..	43·90
1928	..	..	..	3·20	1·50	8·70	8·90	1·70	5·20	3·80	18·20	..	51·20
1929	..	3·80	..	1·00	..	6·40	2·80	3·80	1·60	7·00	..	..	26·40
1930	..	2·40	..	2·50	2·50	2·00	6·50	0·40	5·10	1·90	3·70	..	27·00
1931	..	..	..	0·80	1·20	2·40	7·20	2·00	11·20	15·60	4·00	..	44·40
1932	..	1·60	..	0·40	0·40	0·40	7·20	0·80	10·00	21·60	6·10	..	48·50
Average	..	**0·94**	**0·39**	**1·82**	**3·14**	**5·23**	**6·68**	**4·44**	**6·34**	**7·01**	**6·06**	..	**42·06**
						MULAGALAMPALLI.							
1923	..	..	..	..	..	..	4·10	5·00	10·00	6·80	1·80	..	27·70
1924	..	..	..	..	..	..	4·00	4·00	14·10	2·00	4·00	..	28·10
1925	..	..	..	..	6·00	2·80	7·20	4·80	1·40	3·00	..	..	25·20
1926	..	..	1·80	..	1·40	..	4·20	5·30	4·40	..	..	..	17·10
1927	..	..	..	2·00	2·00	2·20	5·10	5·24	8·80	4·12	3·80	..	33·26
1928	..	..	..	..	..	5·30	8·40	6·60	3·70	6·45	..	..	30·45
1929	..	..	..	0·40	..	1·20	5·60	4·00	0·40	3·40	..	..	15·00
1930	..	..	..	..	2·00	1·60	8·40	1·60	3·20	5·20	1·20	..	23·20
1931	..	..	..	..	..	..	4·60	6·60	6·20	4·20	4·00	..	25·60
1932	..	..	0·40	..	0·80	..	5·20	0·80	4·70	2·80	8·00	..	22·70
Average	..	..	**0·22**	**0·24**	**1·22**	**1·31**	**5·68**	**4·39**	**5·69**	**3·80**	**2·28**	...	**24·83**
						KANDIKUPPA.							
1923	..	..	..	..	..	..	1·37	7·11	8·92	3·76	20·89	..	42·05
1924	..	..	..	..	2·14	0·12	4·58	2·26	7·99	4·09	16·63	7·57	45·38
1925	0·13	..	..	..	5·72	1·31	3·03	9·29	0·87	8·75	2·33	5·13	36·56
1926	..	..	2·60	..	..	..	13·42	5·14	7·74	4·14	..	..	33·04
1927	..	..	..	..	..	11·43	9·99	4·69	2·59	1·87	4·22	..	34·79
1928	..	..	..	1·81	0·12	2·04	3·64	3·56	7·66	12·65	..	..	31·48
1929	..	0·03	..	..	..	3·45	2·93	1·19	3·68	9·18	1·17	1·59	23·22
1930	..	0·09	..	..	7·18	5·83	1·15	4·41	4·15	16·97	9·95	1·89	51.62
1931	..	..	..	..	0·10	1·04	6·87	..	2·83	1·23	2·11	0·30	14·48
1932	..	..	..	..	1·72	2·32	11·06	1·35	0·28	6·14	2·10	..	24·97
Average	**0·01**	**0·01**	**0·26**	**0·18**	**1·70**	**2·75**	**5·80**	**3·90**	**4·67**	**6·88**	**5·94**	**1·65**	**33·76**

REMARKS.—If the rainfall at each forest station is compared with that of the other forest stations, and with the rainfall recorded at the revenue stations, wide differences will be noticed. The figures recorded at the forest stations appear to be unreliable and of little value.

APPENDIX IV.

LIST OF RIGHTS ADMITTED AT SETTLEMENT IN THE RESERVED FORESTS OF THE LOWER GODAVARI DIVISION.

Range. (1)	Reserve. (2)	Particulars of concessions, etc. (3)
Polavaram		No rights were admitted at settlement, but the following privileges have been authorized :—
	Beddadanole	(1) Free grazing of cattle owned by Koyas and Reddies, authorized by G.O. No. 1061, dated 18th September 1885.
	Kovvada, Block I	
	Kovvada, Block II	
	Papikonda	
	Kopalli	
		(2) The Koyas and Reddies are exempted from game rules under Notification No. 135—*Fort St. George Gazette*, dated 29th April 1927.
Gokavaram	Sudikonda	Nil.
	Molleru	
	Mallavaram	
	Doramamidi	
	Virabhadrapuram	Right of way for men and cattle to a footpath 2 yards wide from Virabhadrapuram Gandi branching off from the cart track from Timmapuram to Rajanagaram and running in an easterly direction about a mile to the shrine of Virabhadraswami.
	Lakkonda	Nil.
	Tirumalayapalem	
	Doramamidi Extension	
	Labberti	
Peddapur	Rajavommangi	Nil.
	Ultimathula	
	Raghavapatnam	
	Sarlanka	The shrine of Mallikarjunaswami situated in the Mallikarjuna loddi and measuring 15 yards square is kept as an enclosure in the reserve, itself being free from reservation with access to it by Velangi-Anumarthi path 2 miles long and 2 yards wide.
	Vuligogula	Nil.
	Banadapalli	
	Lododdi	Right of the villagers of Kamiligeddu and Amirekula to the use of water of the three spring wells in Yeduvampula loddi for drinking, cooking, bathing and washing and for watering cattle is admitted with access by a footpath branching from Kimiligeddu-Anantagiri path 1 mile 4 furlongs and 2 yards wide.
Rajahmundry	Kandikuppa	I. Right of navigation over the undermentioned creeks are allowed : (1) From Kandikuppa to Pandi over the creek called Musarpad Kalava. (2) Pandi to Neelarevu over Vaddisalapa. (3) Pandi to Pora over Pandi Godavari. (4) Kandikuppa to Pora over Peddarevu Kalava. (5) Kandikuppa to Molletimoga over Kallerevu Kalava. (6) Pora to Molletimoga over Bedara Kalava. (7) Pora to seashore over Chikati Kalava. (8) Gazangi Tippa to Pandi over Nidi Kalava. II. Right on behalf of the inhabitants of Molletimoga and Kothapalem hamlets of Guttinadevi to the use of the water of spring wells at the Karuvaka beach for domestic purposes is allowed with access by the foot path from Molletimoga to the seashore 2 yards wide for men only, length being 7 furlongs.

LIST OF RIGHTS ADMITTED AT SETTLEMENT IN THE RESERVED FORESTS OF THE LOWER GODAVARI DIVISION—*cont.*

Range. (1)	Reserve. (2)	Particulars of concessions, etc. (3)
Rajahmundry—*cont.*	Coringa	Nil.
	Coringa Extension	(1) Right to fish in the Godavari river and in the salt creeks within the reserve is allowed to the general public. (2) Right of navigation over the Godavari river and in the salt creeks within the reserve is allowed to the general public.
Peddapur	Aminabada	Nil.
	Anantagiri	
	Vatangi	
	Annavaram	
	Lingamparti	Right of way for men and cattle to a spring well at the foot of Nagula Konda hill in the reserve about 1 furlong long and 2 yards wide.
	Peddagarangi	Nil.
	Jeddangi	
	Singampalli	
Rajahmundry	Devancheruvu Blocks I & II.	The great northern trunk road 100 feet wide passes through the reserve and is excluded from reservation. The right to the use of the water of Chellayyacheruvu situated inside the reserve touching its southern boundary by men and cattle as usual.
	Upputeru Block II	(1) Right of navigation over the creek called Dongapandi Yeru from the mouth of Pusalamuri-Kotha Kalava to a point about half a furlong north of Dongapandi, hamlet of Losari Gutlupad. (2) Right of navigation over the Surrudu Kalava and Guntarevu Kalava both generally called the Nagidipalem Kalava, about 6 furlongs long inside the reserve from cairn No. 13 near the mouth of Pedda Kalava up to its junction with Upputeru. (3) Right on behalf of the villagers of Losari and Dongapandi, hamlets of Losari Gutlapad to dig wells in S. No. 116 of Losari Gutlapad and use their water for drinking, bathing and cooking purposes, as also for watering their cattle in the hot season when no other water is available in the neighbourhood, as allowed with access by the following paths :— (i) Right of way for men and cattle from Losari to field No. 116 for water 1 mile long 3 yards wide. (ii) Right of way for men and cattle from Dongapandi to field No. 116 for water 3½ furlongs long 3 yards wide.

APPENDIX V (*a*).

FOREST ROADS IN THE LOWER GODAVARI DIVISION.

Range.	Name of the road.	Description of road.					Year of construction.	Capital cost including cost of land acquisition.	Expenditure on maintenance during past ten years.										Mean per cent per annum on capital costs.
		Metal, gravel or earth.	Length.			Width excluding drains.			1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	1930–31.	1931–32.	1932–33.	
			Within reserved forest.	Outside reserved forest.	Total.														
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
			M. F. C.	M. F. C.	M. F. C.	FT.		RS.											PER CENT.
Rajahmundry ..	1 Gravelled approach road to District Forest Officer's quarters.	..	Work not yet complete.			..	1930–31.	668	..	..	..	..	..	..	..	..	..	..	..
Peddapuram ..	Ramanapeta — Lcdoddi road (via Vatangi).	Earth.	7 4 0	17 3 5	24 7 5	12	1896–97 to 1905–06.	12,092	..	300	100	98	434	316	300	1,000	475	590	3·0
	3 Vatangi— Rajavommangi road.	Do.	4 4 0	3 4 0	8 0 0	12	1897–98 to 1901–02.	1,990	75	..	..	161	224	..	..	..	378	..	4·2
	4 Jaddangi — Banadapalli (via Rajavommangi road).	Do.	1 4 0	9 5 0	11 1 0	12	1901–02 to 1907–08.	7,575	200	..	425	..	..	349	..	..	..	..	1·3
Gokavaram ..	5 Tirumalayapalem — Sudikonda road.	Do.	3 0 5	..	3 0 5	12	1890	425	116	43	28	30	..	97	..	..	..	200	12·1
	6 Mallavaram — Makalagandi road.	Do.	2 6 0	3 2 0	6 0 0	12	1910	887	90	21	..	53	..	109	..	..	199	..	5·3
	7 Kaljolla — Rajpudi road.	Do.	4 0 0	2 0 0	6 0 0	12	1913	1,400	50	19	..	30	..	..	..	..	..	121	1·6
	8 (Barry road) connected road from Sudikonda—Tirumalayapalem road to Sudikonda — Mallisala road.	Do.	1 2 2	..	1 2 2	12	1922–23	530	..	..	..	53	..	85	..	..	..	235	7·0
	9 Lingaram — Govindapuram road.	Do.	2 0 0	2 7 0	4 7 0	12	1924	600	64	..	14	64	..	..	166	94	..	..	6·7
	10 Pidithamamidi— Timmapuram road.	Do.	6 0 0	0 0 6	6 0 6	12	1888	582	338	..	153	..	152	..	..	200	..	..	14·5
	11 Timmapuram — Veerabhadrapuram road.	Do.	1 2 4	0 1 6	1 4 0	12	1923	727	..	..	37	20	..	..	200	..	..	139	5·4
	12 Timmapuram — Veerabhadrapuram road extension to meet Local Fund road.	Do.	0 4 3	..	0 4 3	12	1925	61	..	..	..	..	..	..	..	..	..	..	0·0
	13 Sudikonda — Mallavaram road.	Do.	2 2 4	..	2 2 4	12	1925–28	1,957	..	..	..	..	..	..	26	..	238	..	1·4
	14 Sudikonda — Mallavaram road extension to meet Local Fund road.	Do.	1 1 9	0 5 8	1 7 7	12	1928–31	1,207	..	..	..	..	..	..	..	..	..	..	0·0
Polavaram ..	15 Puliramudugudem—Munjulur road.	Do.	1 7 5	2 4 3	4 3 8	12	1897	450	100	..	161	..	..	..	..	..	..	562	18·3
	16 Kopalli — Gumulur road.	Do.	2 5 0	2 3 0	5 0 0	12	1898	1,100	..	..	..	..	..	..	..	..	..	..	0·0
	17 Puliramudugudem— Chemanapalli road.	Do.	1 5 0	..	1 5 0	12	1900	451	..	..	..	..	..	..	..	..	..	..	0·0
	18 Mulagalampalli — Ankannagudem (via Bothapagudem road).	Do.	5 3 0	1 4 0	6 7 0	12	1899	838	..	..	..	..	..	295	548	..	..	60	10·8
	19 Ravutugudem Ankannagudem road.	Do.	7 7 5	0 4 5	8 4 0	12	1890	1,151	181	..	136	50	..	..	..	..	..	..	3·2

APPENDIX V (*b*).

FOREST BUILDINGS IN THE LOWER GODAVARI DIVISION.

Range	Locality.	Building.	Description.	Year of construction.	Capital cost.	Expenditure on maintenance during past ten years.										Mean per cent per annum on capital cost.
						1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	1930–31.	1931–32.	1932–33.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
					RS.											PER CENT.
Rajahmundry.	Cocanada ..	1 District Forest Officer's quarters.	Brick masonry — terraced and tiled.	1927–28	17,169	..	..	..	..	..	451	235	658	524	404	2·62
		Outhouses ..	Brick masonry—tiled ..	Do.	4,446											
		Latrine	Do. ..	Do.	45											
	Rajahmundry	2 Range office ..	Stone masonry—tiled ..	1903	5,195	20	..	100	..	25	..	350	..	9	..	0·90
		Latrine	Corrugated iron ..	1929–30	150											
	Coringa ..	3 Inspection bungalow.	Brick masonry—tiled ..	1926–28	782	..	..	..	..	..	..	..	..	6	3	0·10
				1930	425											
		Outhouses to the inspection shed.	Do. ..	1932–33	500											
	Kandikuppa (Karavaka).	4 Camp shed ..	Brickmasonry—thatched.	1926–27 1929–30	120	..	..	..	..	..	..	..	..	3	31	2·81
	Devancheruvu.	5 Forest guard's shed.	Mud walls—thatched ..	1898	18	..	15	..	..	..	..	..	46	..	19	44·40
	Kandikuppa ..	6 Forester's quarters.	Brick masonry—tiled ..	1921	654	..	..	..	25	..	..	50	..	6	..	1·20
	Yetimoga ..	7 Tana shed ..	Wattle-daub walls—thatched.	1926–27	40	..	..	..	..	..	..	..	..	19	..	7·91
	Laxmipuram ..	8 Four subordinates' sheds.	Do.	1925–26	60	..	..	..	..	62	..	..	116	..	..	29·70
	Polavaram ..	9 Combined office and checking station.	Brick masonry—tiled ..	1926–27	850	..	..	..	..	..	..	70	..	..	76	2·79
		Outhouses ..	Wattle-daub—thatched.	1928–29	21											
Gokavaram ..	Gokavaram ..	1 Range office ..	Brick masonry—tiled ..	1926–28	2,708	..	..	..	..	..	..	..	..	8	..	0·05
	Do. ..	2 Ranger's quarters	Do.	1927–29	4,088	..	..	..	..	..	..	..	..	13	..	0·07
	Sudikonda ..	3 Rest-house ..	Do.	1915	1,450	105	..	123	3	..	78	..	20	..	94	2·23
		Outhouses, kitchen, stables.	Stone masonry and tiled.	1915	451											
	Mallavaram ..	4 Rest-house ..	Brick in mud—thatched.	1896	620	109	65	67	..	199	..	..	96	..	..	8·36
		Outhouses, kitchen, stables.	Wattle-daub—thatched.	1905	21											
	Veerabhadrapuram.	5 Rest-house ..	Plank walls—thatched.	1917	1,399	..	88	..	145	15	69	..	12	45	..	2·56
		Outhouses ..	Wattle-daub—thatched.	1930	65											
	Pidathamamidi.	6 Range camp shed.	Do.	1908	80	64	..	..	..	..	..	..	42	..	30	17·00
	Mallavaram ..	7 Forester's quarters (Range camp shed).	Do.	1907	61	..	23	..	50	..	..	55	..	..	..	20·98
	Bhavaram ..	8 Range camp shed.	Do.	1908	61	37	..	..	25	..	..	20	..	..	26	17·70
	Veerabhadrapuram.	9 Forester's quarters. (Range inspection shed).	Brick in mud—tiled ..	1908	370	258	..	..	..	100	..	..	..	..	..	9·06
		Outhouses ..	Wattle-daub—thatched.	1908	25											
	Jaddangi ..	10 Range camp shed.	Wattle-daub—tiled ..	1907	260	208	..	..	130	..	..	..	82	..	..	13·59
		Outhouses ..	Do. ..	1907	49											
	Lagarayi ..	11 Range camp shed.	Brick in mud—tiled ..	1908	260	96	6	171	103	..	..	70	..	..	..	17·15
	Gokavaram ..	12 Tana shed (Range camp shed).	Wattle-daub—thatched.	1908	164	30	..	..	25	..	59	..	..	..	..	6·95
	Folkespet ..	13 Tana shed ..	Do.	1906	44	..	20	..	..	125	..	..	50	..	26	50·22
	Kothapalli ..	14 Do. ..	Do.	1906	48	..	10	..	15	..	19	..	..	..	11	11·46
	Yellavaram ..	15 Do. ..	Do.	1905	36	..	14	..	17	..	..	..	..	..	6	10·28
	Jaggampet ..	16 Do. ..	Do.	1905	80	..	25	..	..	..	30	..	..	..	30	10·63
	Sudikonda ..	17 Forester's quarters.	Do.	1925–26	93	..	..	..	..	..	22	..	..	..	28	7·67

APPENDIX V (*b*)—*cont.*

FOREST BUILDINGS IN THE LOWER GODAVARI DIVISION—*cont.*

Range.	Locality.	Building.	Description.	Year of construction.	Capital cost.	Expenditure on maintenance during past ten years. 1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	1930–31.	1931–32.	1932–33.	Mean per cent per annum on capital cost.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
					RS.											PER CENT.
Gokavaram—*cont.*	Molleru ..	18 Forester's quarters.	Brick in mud—tiled ..	1908	326	29	..	..	..	80	..	..	53	..	..	4·97
	Pidathamamidi.	19 Forester's quarters.	Do. —thatched.	1909	262	..	28	6	..	..	..	79	..	24	..	5·23
	Do.	20 Forest Guard's quarters.	Wattle-daub—thatched.	1909	50	..	..	..	..	..	..	30	..	16	..	9·20
	Do.	21 Forest Watcher's quarters.	Do.	1909	30	18	..	..	..	..	..	34	..	10	..	20·67
	Veerabhadrapuram.	22 Forest Guard's quarters.	Do.	1911	108	..	15	..	15	..	30	..	..	24	..	7·78
Polavaram ..	Mulagalampalli.	1 Rest-house ..	Brick in mud—tiled ..	1890	2,482	..	..	100	10	35	12	..	..	663	..	2·85
		Kitchen, stable ..	Corrugated iron walls and roof.	1913	400											
	Jangareddigudem.	2 Range office ..	Stone in mud—tiled ..	1913	1,141	..	..	20	199	5	23	..	195	..	47	4·28
		3 Range Officer's quarters.	Brick in mud—tiled ..	1916	2,965	35	..	190	30	33	40	28	..	15	10	1·27
		Stables	Split bamboo walls—roof thatched.	1918	35											
	Do.	4 Range clerk's quarters.	Brick in mud—tiled ..	1915	722	50	..	110	..	18	..	33	..	..	40	3·48
	Do.	5 Range Peon's quarters.	Do. ..	1915	431	..	..	80	..	..	21	..	..	..	30	3·04
	Do.	6 Forest Guard's quarters.	Wattle-daub—thatched.	1919	50	20	..	..	25	..	28	..	30	..	..	20·60
	Do.	7 Forest Watcher's quarters.	Do.	1916	50	..	..	15	..	25	9	..	25	..	19	18·06
	Mulagalampalli.	8 Forester's quarters.	Stone in mud—tiled ..	1922	929	..	..	12	..	..	..	..	..	..	50	0·67
	Kannapuram	9 Permit Issuing Gumasta's quarters.	Mud walls—tiled ..	1907	310	..	..	..	25	..	100	..	..	25	..	4·84
	Laxminarayanadevipeta.	10 Tana shed ..	Thatched shed	1898	13	..	..	20	..	..	..	..	..	..	..	15·38
	Kamayapalem.	11 Range Camp shed.	Wattle-daub—thatched.	1910	125	..	..	..	..	..	..	25	..	..	21	3·68
	Bothapagudem.	12 Do.	Do.	1927	100	..	..	..	..	..	..	25	..	..	22	4·70
	Puchikapad ..	13 Do.	Do.	1918	48	15	..	..	..	25	..	27	..	..	19	1·79
	Mulagalampalli.	14 Do.	Do.	1910	125	..	..	20	..	23	..	25	..	..	21	7·12
	Kannapuram	15 Do.	Do.	1909	125	..	..	20	..	25	..	27	..	..	26	7·84
	Veerampalem	16 Do.	Do.	1910	56	..	..	..	25	..	..	28	..	..	19	12·86
	Puliramudugudem.	17 Do.	Do.	1907	100	50	..	20	..	25	..	27	..	..	25	14·70
	Laxminarayanadevipeta.	18 Do.	Do.	1909	125	..	..	22	..	25	9	26	..	25	..	8·56
	Chedur ..	19 Do.	Do.	1907	242	45	15	..	40	..	..	27	11	..	30	6·94
	Ravigudem ..	20 Do.	Do.	1925	100	..	..	..	..	..	..	32	27	..	30	8·90
	Koratur ..	21 Do.	Do.	1920	90	..	40	..	..	20	..	..	23	..	..	9·22
	Ravigudem ..	22 Rest house ..	Stone in chunam .. thatched.	1926–30	3,337	..	..	..	..	..	..	..	5	..	104	0·03
		Outhouses ..	Wattle-daub—thatched.	1926–30	250											
	Dandipudi ..	23 Range Camp shed.	Do.	1913	50	..	..	..	25	..	22	..	..	..	20	13·40
	Puliramudugudem.	24 Rest-house ..	Stone in mud—tiled ..	1928–32	3,438	..	..	..	..	..	..	..	..	..	..	..
		Outhouses.	Wattle-daub—thatched.	1928–32	115											
Peddapur ..	Lododdi ..	1 Rest-house ..	Stone masonry—tiled ..	1911	2,121	30	..	110	17	21	..	104	23	29	13	1·14
		Outhouses ..	Stone in mud—tiled ..	1912	920											
	Rajavommangi.	2 Rest-house ..	Stone masonry—tiled ..	1910	1,880	30	..	168	21	47	..	23	81	..	65	1·86
		Outhouses ..	Do. ..	1912	458											

Peddapur—*cont.*	Vatangi ..	3	Rest house ..	Plank walls—thatched.	1897	500	121	..	..	60	9	24	20	5	18	75	6·15
			Outhouses ..	Wattle-daub—thatched.	1897	40											
	Do. ..	4	Range Camp shed.	Do. tiled ..	1906	100	10	6	42	8	12	46	..	31	17	26	13·29
			Outhouses ..	Do. thatched.	1907	49											
	Raghavapatnam.	5	Range Camp shed.	Brick in mud—tiled ..	1910	361	34	4	..	70	8	..	25	35	17	..	4·69
			Outhouses ..	Wattle-daub—thatched.	1912	50											
	Routalapudi ..	6	Range Camp shed.	Brick in mud—tiled.	1910	361	42	12	50	60	12	..	17	3	15	..	5·13
			Outhouses ..	Wattle-daub—thatched.	1912	50											
	Lododdi ..	7	Range Camp shed.	Brick in mud—thatched.	1901	100	10	6	40	8	5	54	..	72	17	..	14·42
			Outhouses ..	Wattle-daub—thatched.	1907	47											
	Kondalingamparti.	8	Range Camp shed.	Brick in mud—thatched.	1907	100	28	6	25	20	10	55	25	72	14	39	19·73
			Outhouses ..	Wattle-daub—thatched.	1907	49											
	Puligogulapad.	9	Range Camp shed.	Brick in mud—thatched.	1907	100	4	82	..	30	8	21	..	27	..	102	18·39
			Outhouses ..	Wattle-daub—thatched.	1907	49											
	Annavaram (Jaddangi).	10	Range Camp shed.	Brick in mud—tiled ..	1920	350	6	6	10	..	6	5	..	6	..	62	2·89
	Rajavommangi.	11	Range Camp shed.	Do. thatched.	1897	596	70	12	50	..	90	..	9	40	8	34	5·25
	Yelleshwaram.	12	Range office ..	Brick in mud - tiled ..	1907	2,163	105	59	22	65	250	..	34	13	..	130	1·86
			Compound wall ..	Do. ..	1908	1,100											
			Stable	Brick in mud—thatched.	1919	40											
			Kitchen	Do.	1920	340											
	Do.	13	Tana shed (checking station).	Brick in mud—tiled ..	1913	674	49	10	142	36	..	7	8	8	118	67	6·60
	Prathipadu ..	14	Tana shed ..	Mud walls—thatched ..	1905	50	..	..	10	..	..	..	44	4	20	..	15·60
	Kathipudi ..	15	Do. ..	Do. ..	1904	50	12	..	12	..	..	18	..	39	..	15	19·20
	Sarbhavaram.	16	Do. ..	Do. ..	1898	14	14	..	14	..	..	40	..	37	..	..	75·00
	Santhapydipala.	17	Do. ..	Wattle-daub—thatched.	1926–27	70	..	..	..	..	..	18	..	20	..	10	6·86
	Yelleshwaram.	18	Forest line ..	Brick in mud—tiled ..	1908	1,988	161	32	85	100	10	105	95	110	..	84	3·93
	Rajvomangi ..	19	Forester's quarters.	Do. ..	1907	372	10	10	25	..	45	..	7	8	42	..	3·96
	Routalapudi ..	20	Do.	Do.	1920	434	5	6	..	40	5	..	5	..	..	56	2·69
	Annavaram (Jaddangi).	21	Forest Guard's shed.	Do. ..	1905	205	15	17	9	16	6	36	30	49	13	..	9·80
	Vatangi ..	22	Do.	Mud wall—thatched ..	1904	103	..	30	..	..	4	22	..	5	25	..	8·35
	Rajavommangi.	23	Do.	Do. ..	1904	64	..	..	10	..	..	27	..	4	24	..	10·16
	Do. ..	24	Forest Watcher's shed.	Wattle-daub—thatched.	1912	30	..	..	..	..	..	28	..	3	22	..	17·67
	Banadapalli ..	25	Do.	Do.	1912	30	26	..	..	..	..	29	..	4	..	..	19·67
	Lododdi ..	26	Do.	Do.	1900	35	..	..	30	..	..	20	..	3	3	..	16·00

APPENDIX V (*c*).

FOREST WELLS IN THE LOWER GODAVARI DIVISION.

Range.	Locality.	Name of the well.	Description.	Year of construction.	Capital cost.	Expenditure on maintenance during past ten years.										Mean per cent per annum on capital cost.
						1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	1930–31.	1931–32.	1932–33.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
					RS.	RS.		RS.	RS.			RS.		RS.	RS.	
Rajahmundry.	Cocanada ..	1 Attached to District Forest Officer's quarters.	Masonry well	1932–33	94	..	..	..	..	..	..	..	..	..	..	..
Peddapur ..	Yelleshwaram.	2 Attached to the subordinate's quarters.	Do. ..	1900	210	10	..	..	..	..	..	24	..	..	..	1·62
	Rajavommangi.	3 Attached to the Rest-house.	Do.	1913	375	..	..	..	11	..	..	12	..	..	..	0·61
	Kannapuram.	4 Attached to the village.	Do.	1917	437	..	..	..	..	..	..	..	..	..	..	..
Gokavaram ..	Bhavaram ..	5 Attached to Range Inspection shed.	Do.	1908	277	..	..	..	..	..	..	..	..	..	14	0·51
	Jaggampet ..	6 Attached to Tana shed.	Masonry well, Rimclay	1917	29	..	..	..	..	..	..	..	..	..	..	..
	Pidathamamidi.	7 Attached to Range Inspection shed.	Masonry well	1908	128	..	..	..	..	..	..	..	..	..	21	1·64
	Folkespet ..	8 Attached to Tana shed.	Do. ..	1907	128	..	..	..	..	..	..	..	..	..	..	..
	Gokavaram ..	9 Attached to Range Officer's quarters.	Do.	1929–30	299	..	..	..	..	..	..	..	..	14	..	0·47
	Sudikonda ..	10 Attached to the Rest-house.	Do.	..	650	..	..	..	..	..	..	..	..	..	..	..
Polavaram ..	Jangareddigudem.	11 Attached to Range Officer's quarters.	Do.	1917	720	12	..	5	..	..	..	2	..	..	..	0·26
	Mulagalampalli.	12 Attached to the Rest-house.	Do.	1897	174	7	..	15	..	..	..	..	..	..	..	1·27

APPENDIX VI.

Note on the Supply of Fuel to the Port Conservancy Board, Cocanada.

In 1918, the management of Hope Island was taken over by the Forest Department—previous to this it had been under the control of the Marine Department.

In 1874, some local merchants applied to the Collector for the lease of a plot of waste land adjoining Hope Island. A sale notice was issued by the Collector ; and, as no objections were received from the Marine Department, a portion of Hope Island and the adjoining waste land was leased out by the Collector. Shortly after this the Master Attendant, Madras, inspected Hope Island and the leased lands, and protested to Government against the alienation of the portion of Hope Island, as this island was the chief source of supply of fuel for the dredgers and launches at Cocanada. The matter was referred to the Collector who exchanged the leased areas for other land. Government, in approving of the action taken by the Collector, ordered the conservation of Hope Island for the use of the Marine Department subject to the payment of light seigniorage fees for the produce removed from the Island ; and instructions were issued that no Government waste land situated within the limits of the Port should be alienated for private purposes without consulting the Marine Department. The seigniorage fee for fuel was then 6 annas a cubic yard ; and, as the Master Attendant of the Port stated that he was unable to estimate the approximate quantity of fuel that would be required by the Marine Department on account of the inefficient condition of the dredgers, he offered to compound the lease for Rs. 100 per annum. This was accepted by the Collector. Thereafter, the fuel forests of Hope Island were worked by the Marine Department through the agency of contractors who were allowed to appropriate the off-cuts and twigs.

In 1886, the District Forest Officer proposed that Hope Island should be transferred to the control of the Forest Department, but the proposal was not accepted by the Board of Revenue, and it was eventually turned down by Government.

In 1918, the District Forest Officer pointed out that the working of Hope Island was unsystematic and wasteful, and he proposed that it should be transferred to the management of the Forest Department. The proposal was supported by the Collector and the Board of Revenue, and the transfer was sanctioned by Government. Although the Board of Revenue, in recommending the transfer, had stated that the annual requirements of the Port Conservancy Board, to be supplied by the Forest Department, would be about 1,848 cubic yards, i.e., 735 tons at 68 cubic feet per ton, no quantity was specified in the Government Order, which merely stated that the Forest Department should supply the Conservancy Board with its requirements in fuel on payment of a seigniorage of Rs. 100 a year, and that this concession would be subject to reconsideration when normal times returned.

When coupe I of Hope Island was sold in 1919, the quantity of fuel to be supplied to the Port Conservancy Board, Cocanada, was estimated at 800 tons, and the coupe was sold on the following conditions :—

(1) That 800 tons of fuel should be supplied to the Port Conservancy Board free except for the actual cost of felling and transport.

(2) Should the Port Conservancy Board require more than 800 tons of fuel, the demand was to be supplied by the contractor, and the value of the excess quantity at Rs. 2–8–0 per ton would be deducted from the lease amount payable by the contractor.

(3) If the quantity of fuel supplied to the Port Conservancy Board was less than 800 tons, the contractor would pay the Forest Department Rs. 2–8–0 a ton on the difference.

Presumably the value of the standing fuel was estimated at Rs. 2–8–0 a ton.

In subsequent years the demand rose to 1,000 tons and was supplied by the Forest Department. In 1923–24 the Port Officer informed the District Forest Officer that he would probably require about 4,150 tons of fuel during the year ; but later he reduced his indent to 3,000 tons. On receiving this extravagant demand, the District Forest Officer addressed the Conservator through the Collector, pointing out the impossibility of supplying the increasing demand and he suggested that the quantity to be supplied to the Port Conservancy Board by the Forest Department should be definitely fixed. The subject was referred to the Chief Conservator who recommended to Government that for the seigniorage fee of Rs. 100 the quantity should be fixed at 1,600 tons per annum—the estimated yield of the Hope Island forests ; and that the Port Conservancy Board should pay Rs. 6–5–10 per ton, being the approximate cost of management, extraction and delivery. The Government accepted the Chief Conservator's recommendation, and in passing orders added that the rate of Rs. 6–5–10 per ton would be subject to revision from time to time in accordance with the actual cost of management, extraction and delivery. This arrangement is still in force.

APPENDIX VII.

Note on the Rajahmundry Timber Market.

General.—Rajahmundry has been an important timber market from early times, chiefly on account of the cheap water transport provided by the Godavari river, which links the town with the forests on its banks and of the hinterland beyond. In 1786 the Committee of Circuit appointed by the Court of Directors of the East India Company to enquire into the state of the Northern Circars referred to the flourishing trade in timber at Rajahmundry. Since then the construction of an excellent system of canals connected with the Godavari river, and the north-east line of the Madras and Southern Mahratta Railway which passes through Rajahmundry, has facilitated the distribution of timber and greatly developed the timber market.

Source of supply.—Timber and bamboos are floated down to Rajahmundry from —

(1) the Central Provinces, the Nizam's Dominions, and the Jeypore and Bastar states ;

(2) the Upper Godavari division, the Rampa Agency, and the Polavaram range of Lower Godavari division ;

(3) the local zemindari forests of Pithapuram, Polavaram and Gangole.

The average percentage of the market's supplies of timber and bamboos obtained from the Upper and Lower Godavari divisions and the Rampa Agency is as follows :—

Produce.	Upper Godavari division. Per cent.	Polavaram range of the Lower Godavari division. Per cent.	Rampa Agency. Per cent.
Timber	5	Negligible	5
Bamboos	17	9	20

Outlets.—From Rajahmundry, timber and bamboos are exported to —

(1) Kistna, Guntur, Bezwada, Narasaraopet, Masulipatam, and elsewhere.

(2) The delta taluks of East and West Godavari districts.

The produce is transported by canal and by rail.

Business methods.—There are about three or four regular timber merchants at Rajahmundry who invest their own money in the timber trade ; but the bulk of the business is controlled by commission agents. The commission agents are money-lenders, who advance money to forest contractors up to about 60 to 70 per cent of the estimated value of the timber purchased by the forest contractors. The rate of interest averages about 1 per cent per mensem—the present rate—1933—is Rs. 1–0–6 per cent per mensem. The forest contractors enter into a contract with the commission agents, on stamped paper, the chief conditions being :

(1) that the contractors will pay the agreed rate of interest,

(2) that the money-lender will hold the stocks of timber as security against the money advanced, and that he shall have the option of selling the timber as he thinks best,

(3) that the money-lender will be entitled to a commission of 2 per cent on all sales: thus he becomes a commission agent,

(4) the contractor will pay all transport charges, the rent of depot site, and the pay of the watchmen, and

(5) all losses due to fire, theft, etc., will be borne by the contractor.

The commission agent keeps an account with the contractor in which all charges, sales, and other transactions are entered. Thefts are not common ; and it is reported that no fire has ever occurred. The timber market is controlled mainly by the commission agents.

Timber.—The species of timber commonly sold at Rajahmundry are—

1 Teak
2 Rosewood
3 *Pterocarpus marsupium*
4 *Terminalia tomentosa*
5 *Xylia xylocarpa*
6 *Anogeissus latifolia*
7 *Adina cordifolia*
8 *Acacia sundra*
9 *Cleistanthus collinus*
10 *Diospyros melanoxylon*
11 *Chloroxylon swietenia*
12 *Grewia tiliaefolia*
13 *Hardwickia binata*
14 *Lagerstroemia parviflora*

All timber below 4 feet in girth is sold in the round ; while part of the timber over 4 feet in girth is roughly squared. The local classification is as follows :—

Name.	Girth in inches.	Length in feet.	Prices current in 1932.	
			Teak.	Other species.
1 Vasam	Under 18	12 to 18	Rs. 30 to 50 per 100	Rs. 15 to 25 per 100.
2 Bazu	18 to 24	18 to 24	Rs. 100 to 150 per 100	Rs. 75 to 100 per 100.
3 Dulam	24 to 36	Do.	Rs. 6 to 10 each	Rs. 3 to 8 each.
4 Karra	36 to 48	Do.	Rs. 25 to 30 each	Rs. 7 to 15 each.
5 Palaka	Above 48	Do.	Rs. 30 to 60 each.	Rs. 15 to 25 each.
6 Tunaka *	24 to 48	Under 12	According to size and quality.	

* Tunakas of teak and rosewood alone are available.

Bamboos.—The proportion of Dendrocalamus to Bambusa on the Rajahmundry market varies greatly. On an average it is estimated at 40 to 1. Bamboos are classified as follows :—

Name.	Description.	Price per 1,000 in 1932.
		RS.
1 Teppa Karra	Very thin Dendrocalamus	14 to 18.
2 Cheruku Vasam 3 Modati-potu-vasam	Sugarcane props	22 to 25.
4 Baru Veduru	Dendrocalamus of medium thickness.	40 to 50.
5 Sandanam Kanathi	Thick Dendrocalamus	60 to 80.
6 Mollem Kanathi	Thick Bambusa	75 to 150.

Fuel.—The prices of fuel and charcoal fluctuate greatly. The classification and prices in 1932 are as follows :—

Name.	Species.	Price.		
		RS.	A.	
Chiruman	*Anogeissus latifolia*	1	12	per candy.
Tumma	*Acacia arabica*	1	10	,,
Marjathi	Other species	1	6	,,

The price of charcoal is 14 annas to Rupee 1 per bag of 56 lb.

Stocks.—The following statement shows the average stocks of timber and bamboos during the past four years and the stocks in December 1932 :—

Produce.	Stocks in December 1932.	Average stocks for the past four years.	Remarks.
(1)	(2)	(3)	(4)
	LOGS.	LOGS.	
Timber	55,000	319,700	The figures were collected by Mr. R. Sahai, Assistant Conservator of Forests.
Bamboos	727,000	10,946,600	

Present position and future prospects.—The present stocks are much below the average. This is due partly to the general slump in trade, and partly to the unwillingness of the Commission Agents to finance the forest contractors on account of the heavy losses that they have incurred in the past two years. Business on the Rajahmundry timber market is greatly influenced by the price of paddy, sugarcane and tobacco—chiefly paddy. When the price of paddy is up, trade in timber flourishes ; when the price of paddy drops the timber market is dull. The timber merchants think that the timber market will not improve until commodity prices go up.

APPENDIX VIII.

CONTROL FORMS.

Control Book for the Mangrove Clear-felling Working Circle.

Prescriptions of the plan.						Results of operations.									Remarks.
Year.	Locality to be exploited.				Type of felling.	Year.	Locality exploited.				Type of felling.	Yield per acre.	Total outturn.	Selling price per acre.	
	Coupe number.	Location.	Area in acres				Coupe number.	Location.	Area in acres.						
			Wooded.	Total.					Wooded.	Total.					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
A. CORINGA SECTOR.															
(1) *Coringa Felling Series.*															
1934–35	I	Compartment 4.	261	293	Clear-felling.	1934–35 ..	I	Compartment 4.	250	282	Clear-felling.	8·5 tons.	2,125 tons.	Rs. 28.	11 acres were left unfelled. This area has been surveyed and marked on the control map.
B. KANDIKUPPA SECTOR.															
(1) *Pandipallam Felling Series.*															
1934 35	I	Compartments 4 and 5.	177	208	Clear-felling.	1934–35 ..	I	Compartment 4 and 5.	170	201	Clear-felling.	5·2 tons.	884 tons.	Rs. 10.	7 acres were left unfelled. This area has been surveyed and marked on the control map.

Record of Works for the Mangrove Clear-felling Working Circle.

Prescriptions of the plan.				Results of operations.					Remarks.
Year.	Locality.	Work.	Unit.	Year.	Locality.	Work.	Unit.	Cost.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			ACS.				ACS.	RS. A. P.	
A. CORINGA SECTOR.									
(1) *Coringa Felling Series.*									
1933–34 before September 1st.	To be selected by District Forest Officer.	Selecting and staking out a sample area on the fresh accretions and closing the same to fishing and the collection of shells.	10	1933–34 July and August.	Compartment 7 a ..	An area was selected by the District Forest Officer, staked and closed to fishing and the collection of shells.	10	24 8 0	Nil.

Control Book for the Mangrove Coppice Working Circle.

A. DONGAPANDI FELLING SERIES.

Year.	Prescriptions of the plan.					Year.	Results of operations.								Remarks.
	Locality to be exploited.				Type of felling.		Locality exploited.				Type of felling.	Yield per acre.	Total outturn.	Selling price per acre. RS.	
	Coupe number.	Location.	Area in acres.				Coupe number.	Location.	Area in acres.						
			Wooded.	Total.					Wooded.	Total.					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
1934-35	1	Compartment 1.	63	69	Simple coppice.	1934-35 ..	I	Compartment 1.	58	64	Simple coppice.	4·2 tons.	243·6 tons.	9	five acres were left unfelled. This area has been surveyed and marked on the control map.

Record of Works for the Mangrove Coppice Working Circle.

Prescriptions of the plan.				Results of operations.					Remarks.
Year.	Locality.	Work.	Unit.	Year.	Locality.	Work.	Unit.	Cost.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1935-36	Last coupe felled.	Experiments with artificial regeneration.	Not defined.	1935-36	Coupe I of Dongapandi felling series.	(1) Seeds of *Acacia arabica* were sown broadcast.	(1) 20 patches aggregating 20,000 square feet.	1 0 0	Nil.
						(2) Cuttings of *Thespesia populnea* were planted.	(2) 200 cuttings.	2 4 0	..

Control Book for the Casuarina Plantation Working Circle.

Year.	Prescriptions of the plan.					Results of operations.										Remarks.
	Locality to be felled.					Locality felled.					Outturn.				Sale price per unit.	
	Coupe number.	Section numbers.	Area in acres.		Type of felling.	Coupe number.	Section number.	Area in acres.		Type of felling.	Stemwood poles and billets.	Branch wood.	Faggot wood.	Stumps.		
			Wooded.	Total.				Wooded.	Total.							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
											TON. C.YDS.	C.YDS.	C.YDS.	NO.		
1939–40 ..	VI	71 to 78	72	76	Clear felling.	VI	71	7·5	7·5	Clear felling	150 2	60	38	2,600	*Billets.*—Rs. 6 per ton of 3 c.yds. *Branch-wood.*—As. 8 per c.yd. *Faggot-wood.*—As. 6 per c.yd. *Stumps.*—Re. 1 per 100.	The mean yield per acre— Billets 21·2 tons. Branchwood 7·8 Cyds. Faggotwood 5·2 c.yds. Stumps 410.
							72	10·0	10·0	Do.	200 1	86	58	4,200		
							73	10·0	10·0	Do.	190 1	82	56	4,000		
							74	10·0	10·0	Do.	205 2	75	48	4,100		
							75	7·5	7·5	Do	145 0	54	42	2,800		
							76	10·8	11·7	Do.	210 0	82	58	4,500		
							77	10·0	10·0	Do.	200 0	75	45	4,300		
							78	6·3	9·3	Do.	125 0	45	28	2,400		
							Total ..	72·0	76·0		Total ..	1,527 tons.	559	378		

Record of Works for the Casuarina Plantation Working Circle.

Year.	Prescriptions of the plan.				Operations actually carried out.							Cost of operations.	Remarks.
	Locality to be treated.				Locality treated.				Outturn.				
	Coupe number.	Section numbers.	Area in acres.	Kind of work.	Coupe number.	Section number.	Area in acres.	Kind of work.	Billets.	Branch. wood.	Faggot wood.		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
									TONS.	C.YDS.	C.YDS.		
1935–36 ..	I	33 to 40	78·0	Planting with casuarina at an espacement of 7′ × 7′.	I	33 to 40	78·00	Planted with casuarina at an espacement of 7′ × 7′.	..	..	..	..	Planting commenced on June 29th and was complete on July 10th.
1935–36 ..	VII	63 to 70	77·5	Thinning (modified mechanical).	VII	63	9·75	Thinned on the lines prescribed in the plan.	31 2	20	25	..	Costs will be found in the plantation journal. Detailed costs will be found in the plantation journal.
						64	10·00		33 2	22	26	..	
						65	10·00		33 0	19	23	..	
						66	10·00		35 0	25	31	..	
						67	4·70		16 0	9	11	..	
						68	10·00		32 1	19	23	..	
						69	10·00		35 1	21	26	..	
						70	13·05		43 1	27	32	..	
1935–36 ..	II	..	5·0	Laying out a sample plot for determining correct rotation.	II	37	5·00	A 5 acre plot was laid out on the lines prescribed in the plan.	..	..	..	..	Cost Rs. 1–2–0.

Headings for the Casuarina Plantation Journal.

I Brief History of the Plantation.

II Notes on Nursery Work.
(this will include a monthly statement of costs).

III Planting.
1 Organization.
2 Time taken and mean daily outturn.
3 Replacement of casualties.
4 Monthly statement of costs.

IV Watering.
1 Organization.
2 Monthly statement of costs.

V Pruning.
1 Cost.
2 Total yield in branch wood and faggots.

VI Thinnings.
1 How done.
2 Costs.
3 Total yield in billets, branch wood and faggots.

VII Felling.
1 How organized.
2 Time taken and mean daily outturn.
3 Cost.

VIII Record of yields—By sections.

Section number.	From pruning.		From thinning.		From final felling.				Total yield.			Remarks.
(1)	Billets. (2)	Faggot wood. (3)	Billets. (4)	Branch wood. (5)	Faggot wood. (6)	Billets. (7)	Branch wood. (8)	Faggot wood. (9)	Billets. (10)	Branch wood. (11)	Faggot wood. (12)	(13)
												Abnormal yields will be explained here.

IX Damage done by insects, and preventive measures taken.

X Silvicultural notes.
(Separate pages will be allotted for each species).

XI Experiments.
(Separate pages will be allotted for each experiment).

XII Financial statement.

At the end of each year a financial statement will be drawn up in the form of Profit and Loss account, as shown in section 10 of Part II, Chapter IV (paragraph 270).

Control Book for the Timber Clear-felling Working Circle.

Prescriptions of the plan.					Results of operations.										
	Locality to be exploited.					Locality exploited.				Total outturn.					
Year. (1)	Coupe number. (2)	Location. (3)	Area in acres. (4)	Type of felling. (5)	Year. (6)	Coupe number. (7)	Location. (8)	Area in acres. (9)	Type of felling. (10)	Description. (11)	Number. (12)	c.ft. (13)	Yield per acre. (14)	Selling price per acre. (15)	Remarks. (16)
							A. BEDDADANOLE FELLING SERIES.								
1934-35 ..	I	Compt. 9.	33	Clear-felling ..	1934-35.	I	Compt. 9.	33	Clear-felling ..	*Teak—*			*Teak—*	RS. 48	..
										Palaka	10	215	60·6 c.ft		
										Karra	42	671	*Other saleable timber—*		
										Dulam	115	808	56·0 c.ft.		
										Bazu	44	176	*Fuel—*		
										Vasams	65	130	Two cart-loads.		
												2,000			
										Other timber—					
										Palaka	12	280			
										Karra	51	811			
										Dulam	55	442			
										Bazu	45	182			
										Vasams	70	135			
												1,850			
										Fuel—					
										Cart-loads ..	66				

Record of Works for the Timber Clear-felling Working Circle.

Prescriptions of the plan.					Results of operations.							Remarks.
Year. (1)	Locality. (2)	Work. (3)	Unit. (4)	Month. (5)	Year. (6)	Locality. (7)	Work. (8)	Unit. (9)	Month. (10)	Total cost. (11)	Cost per unit. (12)	(13)
										RS. A. P.	RS. A. P.	
1935-36 ..	Coupe I, Beddadanole felling series.	First weeding.	Entire coupe 33 acres.	August ..	1935-36	Coupe I ..	First weeding.	Entire coupe 33 acres.	August ..	35 1 0	1 1 0 per acre.	Nil.

Control Book for the Papikonda Experimental Working Circle.

Prescriptions of the plan.					Results of operations.										
	Locality to be exploited.					Locality exploited.				Total outturn.					
Year.	Coupe number.	Location.	Area in acres.	Type of felling.	Year.	Coupe number.	Location.	Area in acres.	Type of felling.	Description.	Number.	C.FT.	Yield per acre.	Selling price per acre.	Remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
1936–37 . .	I	Compt. 5.	188	Partial clear-felling and selection fellings over rest of coupe.	1936–37 . .	I	Compt. 5.	28	Clear-felled.	Teak logs . .	540	9,600	Teak 51·1 c.ft.	. .	The coupe was worked departmentally.
										Rosewood logs . .	28	300			
								160	Selection fellings.	*Terminalia tomentosa.*	240	4,400	Other species 44 c.ft.		
										Xylia	88	1,400			
										Other species . .	162	2,200			
										Total . .	**1,058**	**17,900**			

Record of Works for the Papikonda Experimental Working Circle.

Prescriptions of the plan.					Results of operations.							Remarks.
Year. (1)	Locality. (2)	Work. (3)	Unit. (4) ACS.	Month. (5)	Year. (6)	Locality. (7)	Work. (8)	Unit. (9) ACS.	Month. (10)	Total cost. (11) RS.	Cost per unit. (12)	(13)
1936–37 . .	Coupe I . .	Climber cutting.	188	March	1936–37	Coupe I . .	Climber cutting.	188	March	33	Six annas per acre.	Nil.

Control Book for the Upland Coppice Working Circle.

Prescriptions of the plan.					Results of operations.										
Year.	Locality to be felled.				Year.	Locality felled.				Outturn.				Sale price per unit.	Remarks.
	Felling series.	Coupe number.	Area in acres.	Type of felling.		Felling series.	Coupe number.	Area in acres.	Type of felling.	Total.		Per acre.			
										Fuel.	Small timber.	Fuel.	Small timber.		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9) ACS.	(10)	(11)	(12)	(13)	(14)	(15) RS.	(16)
							A. SUDIKONDA SECTOR.								
1934–35.	Sudikonda.	I	60·5	Simple coppice ..	1934–35.	Sudikonda ..	I	60·5	Simple coppice ..	726 tons 40 c.ft. ..	325 c.ft. ..	12 tons ..	5 c.ft. ..	35	Nil.

Record of Works for the Upland Coppice Working Circle.

Prescriptions of the plan.					Results of operations.							
Year. (1)	Locality. (2)	Work. (3)	Unit. (4)	Month. (5)	Year. (6)	Locality. (7)	Work. (8)	Unit. (9)	Month. (10)	Total cost. (11)	Cost per unit (12)	Remarks. (13)
			ACS.							RS. A. P.	RS.	
						I. SUDIKONDA FELLING SERIES.						
1935–36 ..	Coupe I ..	Eradication of climbers and cutting back soft woods.	Entire coupe of 60·5 acres.	Not prescribed.	1935–36 ..	Coupe I ..	Eradication of climbers and cutting back soft woods.	Entire coupe of 60·5 acres.	June ..	60 8 0	1 per acre.	Nil.

Control Book for the Teak Conversion Working Circle.

Prescriptions of the working plan.					Results of operations.						
	Locality to be exploited.					Locality exploited.					
Year. (1)	Coupe number. (2)	Location. (3)	Area in acres. (4)	Type of felling. (5)	Year. (6)	Coupe number. (7)	Location. (8)	Area in acres. (9) ACS.	Type of felling. (10)	Total outturn. (11)	Remarks. (12)
						A. NORTHERN FELLING SERIES.					
1935-36	II	5	10	Clear felling	1935-36	II	5	10	Clear felling	2,250 c.ft. of timber	The timber was sold in auction for Rs. 1,125 averaging 8 annas per c.ft. The cost of felling and extraction was Rs. 625 leaving a net profit of Rs. 500 equivalent to Rs. 50 per acre.
						B. SOUTHERN FELLING SERIES.					
1935-36	II	37	11	Clear felling	1935-36	II	37	11	Clear felling	785 c.ft. of timber and 120 cart-loads of fuel.	The coupe was sold in auction at Rs. 465 equivalent to Rs. 45 per acre.

Record of Works for the Teak Conversion Working Circle.

Prescriptions of the plan.					Results of operations.							Remarks.
Year. (1)	Locality. (2)	Work. (3)	Unit. (4) ACS.	Month. (5)	Year. (6)	Locality. (7)	Work. (8)	Unit. (9) ACS.	Month. (10)	Total cost. (11) RS. A. P.	Cost per unit. (12) RS. A. P.	(13)
					A. NORTHERN FELLING SERIES.							
1935-36	Coupe II	First weeding.	The entire coupe of 10 acres.	August	1935-36	Coupe II	First weeding	The entire coupe of 10 acres.	June 28th to July 5th.	12 8 0	1 4 0 per acre.	Nil.

Control Book for the Bamboo Working Circle.

Year.	Prescriptions of the plan.				Results of operations.								Remarks.
	Locality to be exploited.			Type of felling.	Locality to be exploited.				Type of felling.	Total outturn.		Sale price of coupe.	
	Felling series.	Coupe number.	Area in acres.		Year.	Felling series.	Coupe number.	Area in acres.		Descripion of bamboos.	Number.		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1934-35 ..	Kovvada.	I	2,395	Clear-felling the older half of each clump.	1934-35 ..	Kovvada.	I	2,395	Clear-felling the older half of each clump.	(1) Mudati-potu-vasam.	25,000	The whole felling series was sold for Rs. 6,000.	Nil.
										(2) Baru-Veduru ..	12,000		
										(3) Sandanam Kanathi.	8 000		
										(4) Mollem Kanathi.	400		
										Total ..	**45,400**		

Control Book for the Minor Products Working Circle.

Year of period. (1)	Kind of produce. (2)	Unit worked or sold. (3)	Prescriptions of the working plan. (4)	Method of working.			Outturn. (8)	Revenue realized. (9)	Remarks. (10)
				Agency of exploitation. (5)	Rotation. (6)	Method of collection. (7)		RS.	
1934–35 ..	Gedara bark ..	Coringa and Coringa Extension reserves.	The method of working is left to the discretion of the District Forest Officer.	Leased to a contractor.	Two years ..	The trees are lopped and the barks are removed from the lopped branches.	30 maunds ..	125	Nil.
1934–35 ..	Thangedu bark ..	Polavaram range ..	Do.	Do.	Three years ..	Coppicing and removal of bark from twigs.	100 maunds ..	500	The market has slumped badly.

Control Book for the Grazing Working Circle.

Year.	Prescriptions of the working plan.						Results of operations.							Remarks.
	Areas prescribed for closure to grazing.						Areas closed to grazing.							
	Permanent.			Periodical.			Permanent.			Periodical.			Burnt areas closed for recuperation.	
	Reserved forest.	Compartment coupe or other locality.	Area in acres.	Felling series.	Coupes.	Area in acres.	Reserved forest.	Compartment coupe or other locality.	Area in acres.	Felling series.	Coupes.	Area in acres.		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
						A. RAJAHMUNDRY RANGE.								
1936–37 ..	.. Coringa Extension.	Compartments, 1a, 1b, 2b, 22b, 22c, 22d, 22e, 22f, 22g and 23b.	2,357	1 Coringa .. 2 Hope Island .. 3 Bhyravapalem. 4 Casuarina plantation.	I to III .. Do. .. Do. .. Do. ..	936 776 953 304	Coringa Extension.	Compartments 1a, 1b, 2b, 22b, 22c, 22d, 22e, 22f, 22g and 23b.	2,357	1 Coringa .. 2 Hope Island .. 3 Bhyravapalem. 4 Casuarina plantation.	I to III .. Do. .. Do. .. Do. ..	936 776 953 304	Nil.	Nil.
	Kandikuppa ..	Compartments 4, 5, 6, 7, 8 and 9.	3,911	5 Devancheruvu. & 6 East and West.	Do. ..	242	Kandikuppa ..	Compartments 4, 5, 6, 7, 8 and 9.	3,911	5 Devancheruvu. and 6 East and West.	Do. ..	242		
				7 Dongapandi .. 8 Losali .. .. 9 Kottapusalamuri.	Do. .. Do. .. Do. ..	197 531 278				7 Dongapandi .. 8 Losari .. .. 9 Kottapusalamuri.	Do. .. Do. .. Do. ..	197 531 278		
		Total ..	**6,268**			**4,217**			**6,268**			**4,217**		

Proceedings of the Chief Conservator of Forests

Proceedings No. 489, Press, 12th November 1934

Working Plan—Lower Godavari Forests—Sanctioned.

A. Wimbush, Esq., I.F.S.,
Chief Conservator of Forests.

Read—the following paper :—

Letter from the Conservator, Working Plans Circle, dated 29th September 1934, No. 753/30–A.

Proceedings—No. 489, Press, dated 12th November 1934.

Sanctioned.

2. Since the working plan was written the intention to build a skidway or timber slide from the Tenakonda saddle to Koratur in Papikonda Reserved Forest has been abandoned. In its place a road has been traced by the Forest Engineer and the construction of this road has been commenced.

A. Wimbush,
Chief Conservator of Forests.

(True copy)

C. Shelswell,
Personal Assistant.

To the Conservator of Forests, Working Plans Circle.
,, Conservator of Forests, Waltair Circle.
,, District Forest Officer, Lower Godavari Division.

Copy to the other Conservators and District Forest Officers.
,, Principal, Madras Forest College.
,, Working Plans Officers.
,, Provincial Sylviculturist.
,, President, Forest Research Institute, Dehra Dun.